

# KELP FOREST MONITORING ANNUAL REPORT 1999



CHANNEL ISLANDS NATIONAL PARK



National Park Service  
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**KELP FOREST MONITORING  
1999 ANNUAL REPORT**

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## ABSTRACT

Observations and results of the 1999 Channel Islands National Park, Kelp Forest Monitoring Project are described. Population dynamics of 68 taxa, or categories, of algae, fish and invertebrates were measured at 16 permanent sites around the five Park islands. Survey techniques utilized SCUBA and surface-supplied-air, and included quadrats, 5m<sup>2</sup>-quadrats, band transects, random point contacts, fish transects, roving diver fish counts, video transects, size frequency measurements, artificial recruitment modules, and species list surveys. Temperature data were collected using remote temperature loggers. Size frequency measurements were taken from artificial recruitment modules at ten sites. In 1999, five sites had *Macrocystis pyrifera* (giant kelp) forests, and 11 sites were dominated by echinoderms. Of these 11 sites dominated by echinoderms, four were dominated by *Strongylocentrotus purpuratus* (purple sea urchins), two by *S. franciscanus* (red sea urchins), three by both *S. purpuratus* and *S. franciscanus*, one by both *Pachythyone rubra* (aggregated red sea cucumbers) and *S. purpuratus*, and one by both *S. purpuratus* and *Ophiothrix spiculata* (brittle stars).

## EXECUTIVE SUMMARY

Channel Islands National Park has conducted long-term ecological monitoring of the kelp forests around Santa Barbara, Anacapa, Santa Cruz, Santa Rosa, and San Miguel Islands since 1982. Permanent transects were established at 16 sites between 1981 and 1986. In 1999, sites were monitored during seven five-day cruises between June and October. Two additional day trips were conducted to repair several of the transects. The 1999 kelp forest monitoring was completed at all 16 monitoring sites by 32 National Park Service (NPS) and volunteer divers completing a total of 794 dives with over 616 hours of bottom time. This annual report contains a summary of the methods used to conduct the monitoring in 1999 and a brief description of the sites along with the results. All of the data collected during 1999 can be found summarized in the Appendices.

Divers using SCUBA or surface-supply-air completed all quadrats, 5m<sup>2</sup>-quadrats, band transects, random point contacts, fish transects, roving diver fish counts, size frequencies, artificial recruitment modules (ARMs) and video transects. Transect lead line repair and/or bolt replacement were performed as necessary at all locations. Temperature loggers were retrieved and deployed at all sites, except at Pelican Bay, Santa Cruz Island where loggers were deployed but missing. All proposed data collection was completed this year except for temperature data at Pelican Bay.

In 1999, *Macrocystis pyrifera* (giant kelp) forests were present at five of the 16 Kelp Forest Monitoring sites. These sites included Wyckoff Ledge at San Miguel Island, Johnson's Lee North and Johnson's Lee South at Santa Rosa Island, and Cathedral Cove and Landing Cove at Anacapa Island. The remaining 11 sites were dominated by echinoderms. Pelican Bay, Scorpion Anchorage and Yellowbanks at Santa Cruz Island, and Southeast Sea Lion Rookery and Arch Point at Santa Barbara Island were dominated by *Strongylocentrotus purpuratus*. Hare Rock at San Miguel Island and Cat Canyon at Santa Barbara Island were dominated by *Strongylocentrotus franciscanus*. Rodes Reef at Santa Rosa Island and Gull Island at Santa Cruz Island were dominated by both *S. purpuratus* and *S. franciscanus*. Admiral's Reef, Anacapa Island, was dominated by both *S. purpuratus* and the brittle star, *Ophiothrix spiculata*. Fry's Harbor, Santa Cruz Island was dominated by *Pachythyone rubra*, and had a moderate density of *S. purpuratus*, and *Astrangia lajollaensis*.

All three sites on Santa Barbara Island were sea urchin barrens. Although, there are a few areas around Santa Barbara Island that have small kelp forests or patches of kelp, the three monitoring sites represent the state of the kelp forest/rocky bottom habitat well.

At Anacapa Island, the status of the two sites within the ecological reserve and the one site outside the reserve represent the Island well, though not in equal proportion to the amount of area inside and outside

of the reserve. Both Landing Cove and Cathedral cove continue to have kelp forests with *Macrocystis pyrifera* more abundant than in 1998. These sites represent the other areas within the reserve well. Admiral's Reef, outside of the reserve on the side of East Anacapa, continues to be a barren dominated by both *Strongylocentrotus purpuratus* and *Ophiothrix spiculata*. These two species dominate much of the south side of East, and both the south and north sides of Middle and West Anacapa Island. Similar to Santa Barbara Island, with the exception of the ecological reserve and other small patches of kelp forest much of Anacapa is echinoderm barrens.

All five sites on Santa Cruz Island were dominated by echinoderms, mostly *Strongylocentrotus purpuratus*. Kelp forests were present on the West end of the Island, and scattered around the remainder of the Island. There was noticeably more kelp close to shore along the northern side of the Island than has been observed in the past several years.

Kelp forests continue to be relatively abundant around Santa Rosa and San Miguel Islands. However, sea urchin densities continued to increase at all three monitoring sites on Santa Rosa Island, and both sites on San Miguel Island. If increases in sea urchin densities continue, we may observe similar patterns as what occurred several years after the 1983/1984 El Niño.

Overall, *Strongylocentrotus purpuratus*, *S. franciscanus*, and *Lytechinus anamesus* densities increased in 1999. Nine sites had high ( $> 15/\text{m}^2$ ) *Strongylocentrotus purpuratus* densities this year, compared to seven in 1998. In 1999 the *S. purpuratus* densities increased at more sites than they decreased, reversing the decreasing trend observed in 1998. *Centrostephanus coronatus* densities remained about the same since 1998.

Sea urchin wasting disease was observed at four sites this year compared to eight in 1998. The disease was observed at Santa Barbara, Anacapa, and the east side of Santa Cruz Islands, but not at Santa Rosa, San Miguel, and the remainder of Santa Cruz Islands. No sea Star wasting disease was observed this year. Sea star populations are at relatively low densities. However, sea star populations remained the same or increased slightly at most of the monitoring sites this year, reversing their decline over the last two years.

Juvenile rockfish were unusually abundant and observed at all of the Islands this year. The most common juvenile rockfish observed at the kelp forest monitoring sites this year were *Sebastes mystinus* (blue rockfish) and *S. serranoides/flavidus* (olive/yellowtail rockfish). Juvenile *S. mystinus* were observed at all 16 sites and juvenile *S. serriceps* were observed at 13 sites this year.

## INTRODUCTION

The waters of Channel Islands National Park and Channel Islands National Marine Sanctuary contain one-third of southern California's kelp forests (Davies, 1968). Giant kelp, *Macrocystis pyrifera*, is the primary constituent of a southern California kelp forest, and over 1,000 species of macro flora and fauna live in this community (Woodhouse 1981, Engle pers. comm.). The kelp forest serves as food, shelter, substrate, and a nursery to resident as well as migratory species. Many species, while not residents of the kelp forest, are dependent upon the existence and productivity of kelp forests; detrital flux from kelp forests provides an important source of nutrients to nearby rocky shore, sandy beach, and estuary communities. The kelp forests are essential to California's commercial and sport fisheries as well as the recreation and tourist industries.

Channel Islands National Park consists of five of the eight California Channel Islands (San Miguel, Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara) and the submerged lands and waters within one nautical mile of each of the islands. The Channel Islands National Marine Sanctuary overlaps the subtidal portions of the park, and its boundary extends six miles seaward from the Park Islands. Channel Islands National Park also bears the designation of International Biosphere Reserve and State of California Areas of Special Biological Significance. The State of California maintains jurisdiction over the resources within the Park and manages them through the California Department of Fish and Game.

The Kelp Forest Monitoring project is part of the long-term ecological monitoring program at the Park, which is designed to measure the health of the ecosystems. By determining the limits of normal variation and diagnosing abnormal conditions we hope to prescribe remedial action through management recommendations.

Following a five-year design study that began in 1982, the Kelp Forest Monitoring Program was implemented in 1987 by the Park's resource management division, using the protocol established during the design phase (Davis and Halvorson, 1988). Preliminary results and specific design considerations can be found in reports written by Davis (1985, 1986). Richards et al. (1997), describe monitoring efforts and results for 1982-1989. Richards et al. (1993a), Richards et al. (1993b), Richards and Kushner (1994), Kushner et al. (1995a), Kushner et al., (1995b), Kushner et al. (1997a), Kushner et al. (1997b), Kushner et al. (1999), and Kushner et al. (2000) describe the 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997 and 1998 monitoring efforts and results respectively. A review of the kelp forest Monitoring program was conducted in 1995 (Davis et al., 1996).

This report summarizes the monitoring efforts and results from 1999, our eighteenth year of monitoring. It is hoped that these reports will provide some insight into kelp forest dynamics and stimulate further research into the long-term trends and changes in this near-shore ecosystem. We have highlighted some



of the most important observations, and tried to provide a characterization for each site. Organisms are referred to by genus and species, except in the abstract and executive summary where both scientific and common names are used. Common names are cross-referenced to their scientific names in Table 1. Since the design of the kelp forest monitoring project, several genera and species names have been changed. For the most part, the new and the old genus are listed together in this text. The new names are cross-referenced in Table 1.

## METHODS

Abundance's and in some cases size structure of 68 taxa or categories of algae, fish, and invertebrates (Table 1) were measured at 16 permanent sites (Table 2) around the five Park islands (Figure 1). Site and species selection criteria, and sampling protocol are described in the Kelp Forest Monitoring Handbook (Davis et al., 1999). Sites were monitored between June 14<sup>th</sup> and October 1<sup>st</sup> 1999.

Each site is marked by a 100 m long transect affixed to the seabed. The sampling techniques employed to gather patterns of abundance and age structure are summarized in Table 3. At each station, 24 paired 1 m x 1 m quadrats that are systematically arranged along the transect with a random start, 40 continuous and adjacent 1m x 5m quadrats, and 24 paired 3 m x 10 m band transects that are systematically arranged along the transect with a random start, were used to determine densities and distribution of discrete benthic organisms; 600 random non-adjacent points (random point contacts - RPCs) are used to determine percent cover of encrusting invertebrates, algae and substrate composition; four 2 m x 3 m x 50 m fixed transects were used to determine fish abundance; roving diver fish count with a timed count and estimated abundance; video taped transects provide a record of the site appearance; and size frequency measurements were collected to determine age structure and recruitment cohorts. All animals measured for the natural size frequency distributions were located using a band transect type search method. A general species list was established for each site, noting presence/absence and relative abundance for all recognizable species. Artificial recruitment modules (ARMs) are in place at ten of the sites to measure recruitment and population structure of indicator species within the ARMs. A complete description of the monitoring protocols can be found in Davis et. al, 1999.

STOWAWAY<sup>TM</sup> temperature loggers were deployed at all sites. Loggers were encased in underwater housings and attached to stainless steel thread rods cemented to the bottom at each site. HOBOTEMP<sup>TM</sup> temperature loggers were also deployed at each site as a backup in case of STOWAWAY<sup>TM</sup> failure. The HOBOTEMP<sup>TM</sup> loggers were programmed to record temperature every 4.8 hours, and the STOWAWAY<sup>TM</sup> loggers programmed to record temperature every hour. All STOWAWAY<sup>TM</sup> and HOBOTEMP<sup>TM</sup> loggers were factory serviced and calibrated and new O-rings were installed in each underwater logger housing in 1999. At several sites loggers were deployed in the beginning of the summer that were not recently calibrated. These loggers were replaced later on in the summer with recently calibrated loggers.

At most of the sites we deployed both a STOWAWAY temperature logger as the primary recording devise and a HOBOTEMP temperature logger as a backup. When both units were working we made a comparison of several temperatures to see if the loggers were recording within their specifications +- 0.2 °C. The data from the STOWAWAY loggers was used whenever possible, as these have consistently

been the most accurate when the loggers have been sent in for calibration. However, if the STOWAWAY<sup>TM</sup> Logger failed, the data from the HOBOTEMP<sup>TM</sup> were used.

## STATION RESULTS

Sampling was completed at all 16 monitoring sites and a summary of the 1999 status of each site is presented in Table 4. Thirty-two divers (Table 5) collected data on seven five-day cruises between June and October, and two additional divers assisted with lead line repair during pre-season non-sampling cruises in May. A total of 794 dives with 625 hours of bottom time were completed.

A brief description of each site is included with the station results below. Complete data summaries from the sampling protocol are listed in the appendices. Means for quadrats (Appendix A) represent average counts obtained from 24 paired 1 m x 1 m quadrats systematically arranged along the transect with a random start. Means for 5m<sup>2</sup>-quadrats (Appendix B) represent average counts obtained from 40 continuous and adjacent 1m x 5m quadrats. Note that when adult, subadult and juvenile densities for *Macrocystis pyrifera* are listed in the station descriptions, the adult and subadult densities are derived from the 5m<sup>2</sup>-quadrats, and the juvenile densities from the quadrat data unless otherwise noted.

Means for band transects (Appendix C) represent average counts obtained from 24 paired 3 m X 10 m transects systematically arranged along the transect with a random start. Means for random point contacts (Appendix D) represent average percent cover for a given organism, group of taxa, or substrate at 15 quadrats systematically arranged along the transect with a random start. Forty points from each quadrat (600 points total) are used to determine percent cover of selected organisms and substrate within one meter of the bottom. Percent cover may total more than 100% due to layering, (Davis et al., 1999).

Means for fish transects (Appendix E) represent the average of four adjacent and continuous 2 m X 3 m X 50 m transects along the line. It should be noted that this is different from previous years when fish transects were 2m x 3m x 100m. Cases listed refer to the total number of passes over the transect made during sampling. All counts were conducted between 0900 and 1500 hours unless otherwise noted.

The Roving Diver Fish Count data are presented in Appendix F. The first page of this Appendix contains the number of observers that sampled and the total number of species observed for each sampling date and site. The following pages contain the average timed score and estimated abundance of each sampling date and site.

Natural habitat size frequency distributions for invertebrates other than gorgonians and *Stylaster (Allopora) californica* are in Appendix G. *Macrocystis pyrifera* size frequency distributions are in Appendix H. Gorgonian and *Stylaster (Allopora) californica* size frequency distributions are in Appendix I. Size

frequency measurements taken from the Artificial Recruitment Modules were kept separate from the natural habitat measurements and their distributions are in Appendix J. Species lists for all locations are in Appendix K. Video transects were completed for all locations, and the video tapes are stored at the Park's headquarters in Ventura.

This report presents 12 months of temperature data from June 1, 1998 – May 31, 1999 (Appendix L). Data after May 31, 1999 will be presented in the 2000 annual report. Temperature data was collected from 15 of the 16 sites with remote temperature loggers. No data was collected from Pelican Bay, Santa Cruz Island because the logger was not replaced after it disappeared in 1998. All data was collected from the remaining 15 sites, except the following due to missing, destroyed or temperature logger failure. Data are missing from 1/14/99 – 5/31/99 at Johnson's Lee South, Santa Rosa Island, from 8/5/98 – 5/31/99 at Scorpion's Anchorage, Santa Cruz Island, from 7/2/98 – 7/24/98 at Landing Cove, Anacapa Island, from 6/1/98 – 6/16/98 at Arch Point and Cat Canyon at Santa Barbara Island.

This year, as with previous years, sampling at the monitoring sites typically occurs over at least two separate dates, ranging from two weeks to several months apart. Separate sampling dates enables us to conduct fish transects at two different dates at least two weeks apart. During our first visit we attempt to conduct all of the abundance estimate techniques (quadrats, 5m<sup>2</sup>-quadrats, band transects, random point contacts, fish transects, and roving diver fish count). During the second visit, fish transects and any remaining size frequencies are conducted. Occasionally abundance techniques are not completed during our first visit, and are subsequently finished during our second visit. If the time span between samplings appears to have impacted abundance estimates (due to changes in populations) this is noted in this section under the location below. Occasionally, a second sampling is conducted to document these changes.

### **Location: Wyckoff Ledge, San Miguel Island**

1999 sampling dates: 6/30, 9/15

1999 status: Mature kelp forest with relatively little understory algae for this site.

This year Wyckoff Ledge was characteristic of a mature *Macrocystis pyrifera* forest with large and widely dispersed adult *M. pyrifera*. On June 30<sup>th</sup>, *M. pyrifera* canopy cover was thick and was estimated to cover 80% of the transect. Overall, the *M. pyrifera* plants appeared healthy. Both adult and subadult *M. pyrifera* density increased from last year, and were 0.20/m<sup>2</sup> and 0.24/m<sup>2</sup> respectively. Juvenile *M. pyrifera* density was lower than last year at 2.7/m<sup>2</sup>. Cover of *M. pyrifera* on the bottom was 20%, similar to last year. Understory red algae cover was 39%, similar to last year but relatively low compared to the past ten years. *Gigartina* sp. cover was 2.5%. The most notable difference at this site was the decrease in understory

brown algae. Miscellaneous brown algae covered 4.0% of the bottom and consisted of *Dictyoneuropsis reticulata* and other brown macroalgae. *Desmarestia* sp. was much less abundant than the last four years, and most of the plants observed were small. This year's cover was 0.17%, the lowest cover recorded since 1987. *Cystoseira* sp. was also less abundant than the last several years covering 1.5%, the lowest cover since 1989. *Pterygophora californica* was one of the most abundant understory algae. On RPCs, *P. californica* cover was 5.8%, and adult and juvenile densities were 1.0/m<sup>2</sup> and 0.79/m<sup>2</sup> respectively. This is an increase in adult and a decrease in juvenile densities compared to last year. Adult *Laminaria farlowii* was present along the transect in low abundance, but none was observed in quadrats or RPCs. Articulated and encrusting algae covered 17% and 23% of the bottom respectively. This is the lowest cover for encrusting coralline algae since 1991. Bare substrate cover declined to 14%, the lowest since 1991.

The most common miscellaneous invertebrates on random point contacts (RPCs) were hydroids and amphipod tub mats. This category covered 21%. *Diopatra ornata* were notably more abundant than last year, covering 13% of the bottom. *Phragmatopoma californica* were common in the holdfasts of adult *M. pyrifera*, and were notably more common on rock substrate than last year. Their cover increased to 8.5%, the highest cover recorded for this site. Miscellaneous bryozoans covered 9.0% of the bottom. Tunicates and sponges covered 1.0% and 1.2% of the bottom respectively. *Tethya aurantia* were abundant with a density of 0.12/m<sup>2</sup>. *Lophogorgia chilensis* were rare as usual for this site, one was observed on band transects (0.0014/m<sup>2</sup>). *Telia lofotensis* were abundant on the tops and sides of rocks with a density of 0.26/m<sup>2</sup>. *Styela montereyensis* density continued to increase for the second year. This year's density was 0.71/m<sup>2</sup>, the highest since 1989.

*Asterina (Patiria) miniata* were moderately abundant with a density of 2.1/m<sup>2</sup>, similar to past years. Only one leather star, *Dermasterias imbricata*, and no *Mediaster aequalis* were observed. As usual for this site, *Pisaster giganteus* were common on the rocky outcrops within the transect area, but there were few stars directly along the transect where they are counted. Their densities on quadrats and 5-meter quadrats were 0.13/m<sup>2</sup> and 0.045/m<sup>2</sup> respectively. Both small and large *Pycnopodia helianthoides* were observed, and their density was 0.0083/m<sup>2</sup>. *Strongylocentrotus franciscanus* and *S. purpuratus* were common but confined to crevices as is usual for this site. Their densities on quadrats were 0.96/m<sup>2</sup> and 2.9/m<sup>2</sup> respectively. The density for *S. purpuratus* is the highest recorded for this site since monitoring began in 1982. *Strongylocentrotus franciscanus* were often abundant in crevices where *Haliotis rufescens* were found. *Parastichopus parvimensis* were common with a density of 0.29/m<sup>2</sup>. Several *Parastichopus californica* were observed and appeared more common than usual for this site.

*Kelletia kelletii* were abundant and counted on both quadrats and band transects with densities of 1.0/m<sup>2</sup> and 0.46/m<sup>2</sup> respectively. These densities were the highest recorded using these sampling techniques at this

site. Many of the *K. kelletii* were half buried in the sand making them difficult to observe. *K. kelletii* are relatively small compared to other sites, and small individuals (possibly juveniles) were common. Eggs of *K. kelletii* were also common. *Lithopoma (Astraea) gibberosa* density was 0.33/m<sup>2</sup>, similar to previous years. *Haliotis rufescens* were common with a density of 0.022/m<sup>2</sup>. *H. rufescens* shells were collected around the transect, measured and disposed of off the transect. Only one *H. rufescens* shell <30mm was found, indicating little recruitment or possibly high survival of juveniles. *Navanax inermis* were common. The nudibranch, *Phidiana pugnax* was notably abundant, and other nudibranchs were moderately abundant.

Several red rock crab, *Cancer antennarius* were observed along the transect. One *C. productus* molt was observed. There were no crab traps observed near the transect this year. In general, crustaceans are notably abundant and diverse at this site. Most notable were the *Idotea resedata* and *Pugettia producta* in the kelp canopy. Kelp curler amphipods, *Amphithoe* sp. were common.

As usual, fish were more abundant on the western end of the transect at this site. Juvenile *Sebastes* spp. were relatively abundant in the kelp canopy. A large school of adult *Aulorhynchus flavidus* (Tubesnouts) was observed. Similar to last year only one large *Sebastes miniatus* was observed during the roving diver fish count. Juvenile *S. mystinus* were abundant on the bottom and juvenile *S. serranoides* were moderately abundant in the kelp canopy. No adult *S. mystinus* were observed during the roving diver fish count, but several were observed along the transect. Several juvenile *S. miniatus* were observed. Adult *Embiotoca jacksoni* were common, but only a few *E. lateralis* were observed. One male, one female, and one juvenile *Semicossyphus pulcher* were observed during the roving diver fish counts. *Oxyjulis californica* were common. Painted greenlings, *Oxylebius pictus*, were common. Roving diver fish counts were conducted on June 30<sup>th</sup> with four divers observing 22 species and on September 15<sup>th</sup> with four divers observing 23 species.

The temperature loggers were working properly and all temperature data were successfully downloaded.

New eyebolts were installed at 30m and 40m along the transect.

### **Location: Hare Rock, San Miguel Island**

1999 sampling dates: 7/1, 9/15.

1999 status: *Strongylocentrotus franciscanus* barrens.

This site has changed little and continues to be dominated by *Strongylocentrotus franciscanus*. Miscellaneous plants, which consisted entirely of filamentous brown diatoms, covered 9.7% of the bottom, a decrease from last year. Except for a small amount of *Desmarestia* sp. on tops of the large rocks and

some red algae, *Laurencia pacifica*, there was little other macroalgae present along the transect. As usual for this site, no algae was observed on quadrats. Miscellaneous red algae covered 5.2% of the bottom and consisted mostly of *L. pacifica*. Articulated coralline algae were uncommon with a cover of 0.17%. Encrusting coralline algae covered 56% of the bottom. Bare substrate cover increased from last year to 28%, similar to previous years.

Similar to last year, the most common miscellaneous invertebrate on RPCs was the worm, *Dodecaceria fewkesi*. This category increased to 27%, the highest cover recorded at this site. Similar to past years, terebellid worms were moderately abundant in the cobble areas around the transect. *Ophiothrix spiculata* were common and were counted separately during RPC's and then added to miscellaneous invertebrates during data entry. Separately, *O. spiculata* covered 2.0% of the bottom. *Corynactis californica* cover was 7.7%, an increase from last year, similar to past years. *Balanophyllia elegans* and *Astrangia lajollaensis* cover were 1.2% and 1.0% respectively.

*Strongylocentrotus franciscanus* were abundant and dominated the site with a density of 22/m<sup>2</sup>. This is an 85% increase from last year, and the highest density recorded at this site since monitoring began in 1982. As usual for this site, the *S. franciscanus* were observed to have notably long and brittle spines that were easily broken. *S. purpuratus* were common and continued to increase in density for the second year. This year density was recorded at 5.5/m<sup>2</sup>, the highest recorded since 1988. Similar to past years, the *S. purpuratus* were very difficult to see on quadrats because most were almost completely covered with cobble and/or shell debris. *S. purpuratus* appeared more evenly distributed over the transect than in past years, but there were still small areas of high densities. Juvenile *S. franciscanus* were not very common, but juvenile *S. purpuratus* were abundant similar to other sites this year. All of the *Strongylocentrotus* spp. were out in the open and not confined to crevices, typical for this site.

*Asterina miniata* were common along the transect and their density increased from last year to 0.42/m<sup>2</sup>. However, this is still relatively low compared to the densities since 1985, and is similar to the post 1983/84 El Niño scenario. *Pisaster giganteus* were counted on both quadrats and 5-meter quadrats with densities of 0.25/m<sup>2</sup> and 0.31/m<sup>2</sup> respectively. Both of these densities were higher than last year. Small and large *Pycnopodia helianthoides* were common, similar to last year with a density of 0.031/m<sup>2</sup>. *Parastichopus parvimensis* were uncommon (only one was observed on quadrats), but were very large. Several *Parastichopus californica* were observed. Similar to last year, we observed *Ophiothrix spiculata* in moderate numbers, and most were observed in areas of the transect that had cobble.

As usual, *Pandalus danae* were common in the cobble areas of the transect and most were small. Barnacles were moderately abundant over most of the site, and seemed to be a preferred food for *Pisaster giganteus*.

Small fresh *Haliotis rufescens* shells appeared more abundant than last year along the transect, indicating either a increase in recruitment or a increase in mortality. We did not get a chance to turn over many small rocks to look for live juveniles. No *H. rufescens* were observed on band transects. *Kelletia kelletii* were present in low numbers with a density of 0.0083/m<sup>2</sup>. *Aplysia californica* were notably less abundant than last year with a density of 0.0083/m<sup>2</sup>. *Cypraea spadicea* were common, typical for this site with a density of 0.67/m<sup>2</sup>. One juvenile *Lithopoma (Astraea) undosum* was observed on quadrats, these are rare at this site. Similar to last year, the nudibranch, *Navanax inermis* were abundant.

The most notable change in the fish populations at this site were the abundance of juvenile *Sebastes mystinus* and juvenile *S. serranoides*. Juvenile *S. miniatus* were common. Adult *Sebastes mystinus*, *S. serranoides*, and *S. atrovirens*, *S. chrysomelas*, and *Oxylebius pictus* were all common at this site. Both adult and juvenile *O. pictus* were relatively abundant, similar to last year. *Chromis punctipinnis* were common and some were notably large. A small group of *Damalichthys vacca* was observed. One Cabezon, *Scorpaenichthys marmoratus*, was observed. Several females, one male, and no juvenile *Semicossyphus pulcher* were observed. Several *Oxyjulis californica* were observed. *Coryphopterus nicholsii* were common in the low lying cobble areas, but density declined to 0.083/m<sup>2</sup>. Roving diver fish counts were conducted on July 1<sup>st</sup> with four divers observing 24 species and on September 15<sup>th</sup> with five divers observing 23 species.

The STOWAWAY™ logger stopped recording on 5/7/99 at 0336 hours. However, the HOBOTEMP™ logger was working and the recorded temperatures from this logger will be used for the missing data points.

A new eyebolt was installed at the zero (east) end of the transect, and six new bolts were installed between existing bolts to aid in locating this transect. Large swells at this site often abrade the lead line so it breaks in many places. This combined with poor visibility often makes this site difficult to locate. These new bolts should aid in locating the transect during future sampling.

### **Location: Johnson's Lee North, Santa Rosa Island**

1999 sampling dates: 7/20, 7/21, 9/14, 9/29.

1999 status: Kelp forest.

The kelp forest at this site has matured since last summer. *Macrocystis pyrifera* canopy cover was estimated at 80% over the site. *M. pyrifera* densities are lower than last year when they were recorded at the highest densities for this site, however, the plants were noticeably larger. Adult *M. pyrifera* densities



increased while subadult densities decreased since last year as one would expect for a rapidly maturing kelp forest. Adult and subadult densities were  $1.2/\text{m}^2$  and  $0.27/\text{m}^2$  respectively, and juvenile *M. pyrifera* density was  $0.29/\text{m}^2$ , much lower than last year. On the bottom, cover of *M. pyrifera* was similar to last year at 62%.

Understory algae was noticeably less abundant than last year. *Cystoseira* spp. were one of the most abundant understory brown algae with a cover of 3.5%, less abundant than last year. *Laminaria farlowii* were present in low numbers. None were observed on quadrats, and cover on RPCs was recorded at 0.33%, the lowest since 1991. No *Eisenia arborea* were present in the quadrats or RPCs, but a few plants were observed on the tops of the rocky shelves along the transect. Adult and juvenile *Pterygophora californica* densities were  $0.46/\text{m}^2$  and  $0.42/\text{m}^2$  respectively, and cover was 1.5%. Miscellaneous red algae cover was much lower than usual for this site at 8.3%, the lowest cover recorded since 1987. *Gigartina* decreased in cover from last year to 0.17%. Articulated and encrusting coralline algae covered 6.8% and 7.3% of the bottom respectively. Bare substrate decreased for the third consecutive year. This year cover was 7.2%.

NOTE: During our first visit to this site on July 20<sup>th</sup>, 5-meter quadrats were conducted. Unfortunately, one of the divers was incorrectly identifying the primary dichotomy and misidentified many of the adult *Macrocystis pyrifera* plants as subadults. We sampled 5-meter quadrats again on September 14<sup>th</sup>. However, in previous years, quadrats and 5-meter quadrats have always been sampled during the same site visit so that the data can be compared. To stay consistent with this sampling, we decided to use as much of the July 20<sup>th</sup> 5-meter quadrat data as was possible as this is when quadrats were sampled. The data entered into the data base consisted of all of the data collected on July 20<sup>th</sup> from the one diver who was conducting the 5-meter quadrats correctly, and the *Pisaster giganteus* data from both divers. We then entered only the *M. pyrifera* data collected on September 14<sup>th</sup>, from the side of the transect line that the *M. pyrifera* plants were incorrectly identified on July 20<sup>th</sup>. Although there appeared to be some change between the two sampling dates, the results were similar.

Similar to previous years, the most common miscellaneous invertebrates on RPCs were hydroids (mostly *Sertularella/Sertularia*, *Obelia* spp. and *Aglaophenia latirostris*). This category covered 22% of the bottom, an increase from last year. The most noticeable change in encrusting invertebrates was the increase in tunicates, similar to the Johnson's Lee South site. Tunicate cover was 16%, the highest recorded since 1991. Sponge cover was recorded at 2.0%. *Phragmatopoma californica* were abundant covering 13% of the bottom, similar to last year. Bryozoans covered 27% of the bottom, and no *Diaperoecia californica* were counted during RPCs. *Tethya aurantia* density was  $0.13/\text{m}^2$ . *Styela montereyensis* density was  $1.0/\text{m}^2$ , similar to past years. The worm, *Pista elongata*, were common. Small amphipod tube mats were common on the *M. pyrifera* blades, but not as abundant as at Johnson's Lee South. Very small colonies

of bryozoans were extremely abundant on the *M. pyrifera* blades, giving the site a feeling that it had just snowed.

*Strongylocentrotus franciscanus* were common in crevices, and their density along the transect was  $1.5/\text{m}^2$ , the highest density recorded since 1989. Several meters off the line, at meter 36 along the transect, a large group of legal size *S. franciscanus* were present next to a commercial sea urchin collecting bag. It appeared as if the bag was accidentally dropped full of *S. franciscanus*. None of these *S. franciscanus* were directly along the transect, and did not effect the quadrat counts this year. *S. purpuratus* density continues to increase and was recorded at  $30/\text{m}^2$ , the highest density since 1987. There were notably more high-density patches of *S. purpuratus* this year. Note, this increase in *S. purpuratus* is similar to the increase that was observed post the 1983/4 El Niño at this site. If this pattern continues we predict that this site will return to sea urchin barrens as it did in the mid 1980's.

*Asterina miniata* continued to be rare with a density of  $0.042/\text{m}^2$ . *Pisaster giganteus* density increased on both quadrats and 5-meter quadrats, their densities were  $0.29/\text{m}^2$  and  $0.14/\text{m}^2$  respectively. *Pycnopodia helianthoides* were more common than last year, but remained at a relatively low density for this site,  $0.014/\text{m}^2$ . *Parastichopus parvimensis* density was  $0.33/\text{m}^2$ .

Similar to past years, *Cypraea spadicea* density was  $0.63/\text{m}^2$ . Several very large *Lithopoma (Astraea) undosum* were observed, but as usual, they were rare at this site and none were observed in quadrats. *Kelletia kelletii* density was  $0.019/\text{m}^2$ . *Megathura crenulata* were common on the rocky outcrops with a density of  $0.019/\text{m}^2$ . Three *Haliotis rufescens* were observed during band transects,  $0.0042/\text{m}^2$ . Octopi were common at the site, and were present in almost every artificial recruitment module (ARM). No *Aplysia californica* were observed along the transect this year.

Fish were abundant and diverse at this site. *Girella nigricans* were uncommon and only observed on September 14<sup>th</sup>. *Oxyjulis californica* were present but not abundant and usually in small groups of less than 10. Rainbow surfperch (*Hypsurus caryi*), kelp surfperch (*Brachyistius frenatus*), Jack mackerel (*Trachurus symmetricus*) and smelt were all common in the kelp canopy and midwater. Juvenile rockfish were abundant in the kelp canopy and midwater, and consisted mostly of *Sebastes serranoides/flavidus*. Several adult *S. serranoides* were observed. Juvenile *S. mystinus* were common and several juvenile *S. miniatus* were observed along the bottom. A school of approximately 27 Bocaccio, *S. paucispinis*, were observed along the transect. Adult *S. atrovirens* were moderately abundant along the rocky outcrops on the transect. Female *Semicossyphus pulcher* were common, but most were small. One male and two juvenile *S. pulcher* were observed during the roving diver fish count. Several female and male *Halichoeres semicinctus* were observed. Black and yellow rockfish, *S. chrysomelas*, were notably abundant. Adult *Embiotoca jacksoni* were relatively abundant, only a few juveniles were observed. *E. lateralis* were relatively uncommon with only

a few observed during the roving diver fish count on July 21<sup>st</sup>. The resident *Hypsypops rubicundus* at 73 m along the transect was present as usual, and two others were observed along the transect this year.

*Paralabrax clathratus* were present in small numbers. Dan Richards observed a red brotula, *Brosmophycis marginata*, deep in a crevice. Roving diver fish count was conducted on July 21<sup>st</sup>, with seven divers observing 31 species, and on September 14<sup>th</sup> with five divers observing 27 species of fish.

Three ARMs were located in the South group (2392, 2394 and 2397) and two in the middle group (2414 and 2398). Two other ARMs that were present last year were missing from the North group location. We were able to locate two ARMs off the transect, but both were irreparable and will need to be replaced. All of the five intact ARMs found were monitored for all indicator species. In past years, there have been differences in the numbers of some indicator species in the ARMs from the three different groups (north, middle, and south groups), and we have tried to sample equal numbers of the ARMs from the three groups for all indicator species. Since all of the ARMs from the North group are now missing, we will be unable to sample a equal number of ARMs from the three groups. It is possible this will create a bias in the data compared to previous years, and an analysis of variation among the ARMs and three different groups may be needed for thorough analysis.

No *Haliotis* spp. were observed in the ARMs this year. ARM #2411 that has had a relatively large abalone in it for several years is one of the ARMs that disappeared. Two *Crassedoma (Hinnites) giganteum* were found in the five ARMs, 0.4/ARM. *Asterina miniata* were rare with only one measuring 13mm found in the five ARMs, 0.2/ARM, a decrease from last year. *Pisaster giganteus* were more abundant than last year with 1.8/ARM. No *Pycnopodia helianthoides* were found in the ARMs. *Cypraea spadicea* density was similar to last year at 4.2/ARM. *Strongylocentrotus purpuratus* density in the ARMs continue to increase. This year's density was 52/ARM compared with 25/ARM and 3.6/ARM in 1998 and 1997 respectively. The density of *S. franciscanus* also increased, with 19/ARM compared to 9.3/ARM in 1998.

The temperature loggers were working properly and all temperature data was successfully downloaded. An eyebolt was placed on the new 50-meter thread rod that was installed last year, and the lead line was attached. Several line breaks were repaired.

### **Location: Johnson's Lee South, Santa Rosa Island**

1999 sampling dates: 7/20, 7/21, 9/14, 9/29.

1999 status: Mature kelp forest.

The site is described as a mature kelp forest with large, widely spaced *Macrocystis pyrifera* plants, similar to last year. *M. pyrifera* canopy over the transect was estimated at 90% on July 20<sup>th</sup>. Adult, subadult and

juvenile *M. pyrifera* densities were 0.20/ m<sup>2</sup>, 0.23/ m<sup>2</sup> and 0.88/m<sup>2</sup> respectively, and covered 33% of the bottom. Most of the *M. pyrifera* appeared healthy, but the blades had an abundance of epiphytic bryozoans, hydroids, and amphipod tube mats. *Laminaria farlowii* were more abundant than last year, adult and juvenile densities were both 0.79/m<sup>2</sup>. On RPCs, *L. farlowii* covered 21% of the bottom, the highest cover recorded for this site since monitoring began in 1982. Adult and juvenile *Pterygophora californica* densities were 0.083/m<sup>2</sup> and 0.0/m<sup>2</sup> respectively, and covered 1.7% of the bottom. Adult *Eisenia arborea* density was 0.15/m<sup>2</sup>, juveniles were rare with none observed on quadrats, and cover was recorded at 1.7%. Miscellaneous red algae cover was 39%, lower than last year. *Gigartina spp.* cover was recorded at 2.5%. Articulated and encrusting coralline algae covered 11% and 6.5% of the bottom respectively. Bare substrate decreased to a cover of 5%.

NOTE: During our first visit to this site on July 20<sup>th</sup>, 5-meter quadrats were conducted. Unfortunately, one of the divers was incorrectly identifying the primary dichotomy and misidentified many of the adult *Macrocystis pyrifera* plants as subadults. We sampled 5-meter quadrats again on September 14<sup>th</sup>. However, in previous years, quadrats and 5-meter quadrats have always been sampled during the same site visit so that the data can be compared. To stay consistent with this sampling, we decided to use as much of the July 20<sup>th</sup> 5-meter quadrat data as was possible as this is when quadrats were sampled. The data entered into the data base consisted of all of the data collected on July 20<sup>th</sup> from the one diver who was conducting the 5-meter quadrats correctly, and the *Pisaster giganteus* data from both divers. We then entered only the *M. pyrifera* data collected on September 14<sup>th</sup>, from the side of the transect line that the *M. pyrifera* plants were incorrectly identified on July 20<sup>th</sup>. Although there appeared to be some change between the two sampling dates, the results were similar.

Similar to the last three years, hydroids (mostly *Aglaophenia latirostris*) were the most common miscellaneous invertebrate on RPCs. This category covered 23% of the bottom. The most notable change at this site was the increase in tunicate and bryozoan cover, similar to Johnson's Lee North. Sponges decreased to 1.5% cover, while tunicates increased to 11%. This is the highest cover for tunicates recorded at this site since monitoring began in 1982. The observer who conducted random point contacts was positive about the identification of tunicates and sponges. Bryozoans increased to a cover of 35%, the highest cover recorded at this site. *Balanophyllia elegans*, *Astrangia lajollaensis*, and *Corynactis californica* covered 2.8%, 0.5%, and 1.0% of the bottom respectively. *Diopatra ornata* were abundant in the low-lying sandy areas of the transect, their cover was 13%, similar to past years. *Styela montereyensis* continued to increase for the third year and many were small. This year's density was 1.8/m<sup>2</sup> the highest recorded at this site since monitoring began in 1982. *Tethya aurantia* were abundant with a density of 0.23/m<sup>2</sup>. *Lophogorgia chilensis* density was 0.11/m<sup>2</sup>, similar to last year. *Tealia lofotensis* density was 0.085/m<sup>2</sup>, and were common on the tops of large rocks.

*Strongylocentrotus franciscanus* density was similar to last year at  $2.0/\text{m}^2$ . *Strongylocentrotus purpuratus* density continued to increase for the second consecutive year. This year, density was  $8.6/\text{m}^2$ , the highest since 1990. Similar to Johnson's Lee North and past years, it was difficult to conduct size frequency measurements of *S. purpuratus* and *S. franciscanus* because they were often hidden in crevices and difficult to access without harming the animals or conducting invasive sampling. The divers who measured the sea urchins for size frequencies counted the urchins they observed, but could not reach for measurement. They found 28% of the *S. franciscanus* and 36% of the *S. purpuratus* were not accessible for measurement. This could create a sampling bias if a disproportionate number of large or small urchins were not accessible for measurement. *Pycnopodia helianthoides* density was  $0.024/\text{m}^2$ , similar to the past several years. *Asterina miniata* density increased from last year to  $1.5/\text{m}^2$ . *Pisaster giganteus* were counted on both quadrats and 5-meter quadrats, with densities of  $0.13/\text{m}^2$  and  $0.12/\text{m}^2$  respectively. *Parastichopus parvimensis* density was  $0.08/\text{m}^2$ .

This year, four *Haliotis rufescens* were observed during band transects,  $0.0056/\text{m}^2$ . Abalone shells were collected, measured and disposed of off the transect. No *Aplysia californica* were observed this year, a decrease from last year and similar to observations at other sites. *Kelletia kelletii* density was similar to last year at  $0.026/\text{m}^2$ . Several pacific wing-oysters, *Pteria Sterna*, were observed growing on *Lophogorgia Chilensis*. This may be a range extension for *P. sterna*.

As usual for this site, fish were relatively abundant and diverse. Similar to other sites this year, juvenile *Sebastes spp.* were abundant. Juvenile *S. mystinus* and *S. serranoides/flavidus* were the most abundant juvenile *Sebastes spp.*. Small *Damalichthys vacca*, *Embiotoca jacksoni*, *Brachyistius frenatus* (kelp surfperch), small *Oxylebius pictus*, *S. chrysomelas*, *S. atrovirens*, *Hypsurus caryi*, and *Chromis punctipinnis* were all common. One *Medialuna californiensis* was observed. Several *Paralabrax clathratus* and *Embiotoca lateralis* were observed. *Coryphopterus nicholsii* were relatively abundant for this site with a density of  $0.67/\text{m}^2$ , the highest density recorded at this site since 1988. On July 20<sup>th</sup>, we conducted roving diver fish counts with six divers observing 31 species of fish, and on September 14<sup>th</sup> with two divers observing 25 species of fish.

All four ARMs present in 1998 remained intact and monitored for all indicator species this year. We replaced four broken bricks in ARM #2419, and this ARM was moved back to an area where it will hopefully be more stable in large swell conditions. The bricks used were ones at the site present from old ARMs that were destroyed several years ago. Another ARM (no number was acquired) that has been missing for several years was found and was moved closer to the other ARMs. This ARM was mangled and was not sampled however we repaired the cage and reassembled it. There are now a total of five functional ARMs at this site (note: only four were intact for sampling this year).

One *Haliotis rufescens* measuring 34mm was found in the four ARMs. *Asterina (Patiria) miniata* were more abundant than last year with 5.8/ARM. *Pisaster giganteus* were also more abundant with 1.8/ARM. One *Pycnopodia helianthoides* was found in the ARMs, 0.25/ARM. *Cypraea spadicea* density was 5.3/ARM, similar to last year. Juvenile *Crassidoma (Hinnites) giganteus* abundance was similar to last year with 0.75/ARM. Both *Strongylocentrotus franciscanus* and *S. purpuratus* were more abundant than last year. *S. franciscanus* density was 47/ARM compared to 26/ARM in 1998. There was a large range in their size distribution, and most of the animals were larger than 25mm indicating immigration into the ARMs as opposed to recruitment. *Strongylocentrotus purpuratus* density was 14/ARM compared to 2.8/ARM in 1998. Approximately 20% of these were less than 15mm indicating recent recruitment. There was more *Strongylocentrotus spp.* recruitment this year than there has been since 1996 at this site.

On July 20<sup>th</sup>, The temperature logger housing was found in a crevice along the transect. It had broken off the stake, but stayed on the bottom due to the weight that is attached to the housing. Unfortunately, the housing was flooded. The temperature logger circuit boards were removed, dried, and sent to Onset Computer Corporation. Data was downloaded until January 14th, 1999, which is presumably when the housing flooded and the loggers ceased recording.

Five new thread rods/eyebolts were installed at meter marks 0, 30, 50, 60, and 70. We installed an extra long thread rod on the 0 meter mark, so that it would more likely be visible if this area is covered in sand as it has been in past years.

### **Location: Rodes Reef, Santa Rosa Island**

1999 sampling dates: 6/29, 9/16.

1999 status: *Strongylocentrotus franciscanus* and *S. purpuratus* barrens with moderate encrusting invertebrate cover on the western half of the transect.

There was notably less macroalgae at this site than in recent years. Only a few small patches of juvenile *Macrocystis pyrifera* on the tops of large rocks and a small amount of red algae were present along the transect in June. However, several adult *M. pyrifera* and *Eisenia arborea* were present just outside of the transect area. There was a notable decrease in *M. pyrifera* on our second visit to the site on September 16<sup>th</sup>. During this visit we only observed one subadult *M. pyrifera* along the transect. Please note that abundance sampling was conducted during our first visit on June 29<sup>th</sup>. No *E. arborea*, *Laminaria farlowii* or *Pterygophora californica* plants were observed along the transect. Miscellaneous red algae were the most abundant foliose algae, covering 7.8% of the bottom, the lowest cover for this category at this site since 1988. Miscellaneous plants covered 14% of the bottom and consisted of filamentous diatoms; this is the highest cover recorded for this category at this site. Articulated coralline algae were rare and none

were observed on RPCs this year. Encrusting coralline algae was abundant with a cover of 97%; the highest recorded at this site. Please note that a newly trained biological technician conducted the RPCs at this site, and this high cover seems to be a slight over-representation of encrusting coralline algae. However, encrusting coralline algae was very abundant at this site and the data is representative of the transect. Bare substrate was rare covering only 2.5% of the bottom; the lowest recorded at this site.

The most common miscellaneous invertebrates on RPCs were hydroids and *Cucumaria* sp., this category covered 11% of the bottom. The parchment tubeworm, *Chaetopterus variopedatus*, were rare and notably less abundant than last year. *Diopatra ornata* abundance remained low at 0.17%, the lowest cover recorded at this site. *Astrangia lajollaensis* and *Balanophyllia elegans* were more abundant on the western/rocky end of the transect and covered 6.7% and 0.50% of the bottom respectively. Bryozoan cover was similar to last year at 2.3%. *Telia lofotensis* were common on the tops of rocks, and had a density of 0.051/m<sup>2</sup>. *T. coriacea* and *T. colombiana* were also common as usual for this site. *Lophogorgia chilensis* were rare along the transect, and none were observed during band transects. *Styela montereyensis* density was 0.13/m<sup>2</sup>. *Tethya aurantia* were abundant with a density of 0.16/m<sup>2</sup>. The bright orange encrusting tunicate that has been present at this site for the past several years was notably more abundant. This tunicate easily stands out with its fluorescent orange coloration, and often covers relatively large patches of rock or large cobble.

*Strongylocentrotus* spp. continued to increase at this site for the fourth year. Densities and their associated impacts are noticeable enough to describe this site as a sea urchin barren, as opposed to an open area with a moderate amount of foliose algae. *Strongylocentrotus franciscanus* were abundant with a density of 8.8/m<sup>2</sup>. Both large and small *S. franciscanus* were present. *S. purpuratus* continued to increase in density to 18/m<sup>2</sup>, the highest density recorded since 1986. Juvenile *S. purpuratus* less than about 5mm were common on the encrusting coralline rocks. Similar to last year, the *Strongylocentrotus* spp. were evenly distributed around the transect. *Lytechinus anamesus* were common with a density of 0.83/m<sup>2</sup>, the highest density since 1986. Most were present along the low-lying sandy/cobble bottom. The *L. anamesus* were difficult to see because they were small and most were covered with pebbles or shell debris. One small *Centrostephanus coronatus* was observed along the transect, its size was estimated at 25mm.

Overall, sea star density remained relatively low for this site, after decreasing in 1998. *Asterina miniata* remained low at, 0.63/m<sup>2</sup>. *Pisaster giganteus* increased in density to its pre 1998 levels. *P. giganteus* density on quadrats and 5-meter quadrats were 0.46/m<sup>2</sup> and 0.22/m<sup>2</sup> respectively. *Pycnopodia helianthoides* were rare along the transect, and were small. One was observed on band transects with a density of 0.0014/m<sup>2</sup>. Several *Mediaster aequalis* (red sea star), several *Orthasterias koehlerii* (rainbow stars) and one *Dermasterias imbricata* (leather star) were observed along the transect. *Henricia* sp.

(blood stars) were common. Similar to last year, *Pisaster brevispinus* (short spined sea star) were relatively abundant along the eastern half of the transect. *Ophiothrix spiculata* were common, scattered around the bottom. Similar to past years, large *Parastichopus parvimensis* were present on the western/rocky half of the transect, however none were observed on quadrats.

*Kelletia kelletii* density was 0.018/m<sup>2</sup>, similar to last year. Several *Lithopoma (Astraea) gibberosum* were observed along the transect. *Lithopoma (Astraea) undosum* were notably more abundant than in previous years and were mostly present on the higher relief/western end of the transect. Their density was 0.33/m<sup>2</sup>, the highest ever recorded at this site. *Megathura crenulata* density was 0.014/m<sup>2</sup>, and were most common on the western/rocky end of the transect. *Aplysia californica* density was 0.011/m<sup>2</sup>. Three small live *Haliotis rufescens* measuring 20, 20 and 16mm were found (two in a small crevice found during quadrats and one under a small rock), and six small fresh shells of similar sizes were found, indicating recent recruitment. The snails *Mitra idae*, and *Trivia californiana* were both common. Small (<10mm) limpets were abundant on the encrusting coralline surfaces over the entire transect. Several octopi were observed. Approximately 50% of the temperature logger housing was covered with amphipod tube mats.

Similar to previous years, fish were more abundant at the western/rocky end of the transect. Large male *Semicossyphus pulcher* were abundant as usual for this site. Large female *S. pulcher* were common and one juvenile was observed during the roving diver fish count. One *Damalichthys vacca* was observed on June 29th. *Rhacochilus toxotes* (rubberlip surfperch) were observed off the western end of the transect. Adult *Sebastes mystinus* were common. Similar to other sites this year, juvenile *S. mystinus* were relatively abundant. Several juvenile *S. miniatus* were observed. *Embiotoca jacksoni* were common, but only one *E. lateralis* was observed during the roving diver fish count. Several large *Paralabrax clathratus* and *Sebastes serranoides* were observed. Several juvenile *S. serranoides* were observed along the transect, and were abundant off the transect near the *Macrocystis pyrifera* plants. *Sebastes atrovirens* were common and several juveniles were observed. Similar to past years, *Rathbunella hypoplecta* (stripefin ronquil) were relatively abundant along the rocky western half of the transect. *Oxylebius pictus* (painted greenlings) were common. No *Alloclinus holderi* were observed on quadrats this year, and only one was observed at the site, but not during roving diver fish count. One *Stereolepis gigas* (giant black sea bass) was observed by an observer during the roving diver fish count. As usual for this site, parasitic copepods were abundant on the larger *S. pulcher*. The roving diver fish count on June 29<sup>th</sup> was conducted with four divers observing 22 species and on September 16<sup>th</sup> with four divers observing 22 species.

During our second visit to this site on September 16<sup>th</sup>, fish were notably less abundant. Most notably were the lack of *Semicossyphus pulcher*, and *Sebastes atrovirens*. Juvenile *S. miniatus* were less abundant



and notably larger than in June. There also appeared to be a behavioral difference with them actively sitting on the bottom as opposed to hovering off the bottom.

The temperature loggers were working properly and all temperature data was successfully downloaded.

**Location: Johnson's Lee, Santa Rosa Island.**

1999 sampling dates: 9/29.

1999 status: Mature kelp forest.

We conducted a night dive just offshore of the Johnson's Lee North site. We were anchored in a sand channel at a depth of 45 ft and had excellent dive conditions. The most notable observations were the moderately abundant juvenile *Strongylocentrotus purpuratus* that were out foraging. These small *S. purpuratus* are rarely observed at the both the sites in Johnson's Lee during the day. Presumably, both Johnson's Lee South and North have similar abundance's of juvenile *S. purpuratus*.

**Location: Gull Island South, Santa Cruz Island**

1999 sampling dates: 6/28, 8/19, 9/28.

1999 status: *Strongylocentrotus purpuratus* and *S. franciscanus* barrens.

Overall, this site continues to be dominated by both *Strongylocentrotus purpuratus* and *S. franciscanus*, and is considered barrens. Although the transect has changed little, most of the areas surrounding Gull Island and inshore had a noticeable increase in *Macrocystis pyrifera* canopy cover.

Along the transect there were several small patches of subadult *M. pyrifera* and an occasional juvenile. Adult, subadult, and juvenile *M. pyrifera* densities were  $0.0/\text{m}^2$ ,  $0.035/\text{m}^2$  and  $0.0/\text{m}^2$  respectively, and none were observed on random point contacts. Below the transect on the northwestern end, adult and subadult *M. pyrifera* were common, and several of the plants formed a small canopy. Several juvenile *Eisenia arborea* were observed on top of the high relief areas of the transect, and one was observed during quadrats ( $0.042/\text{m}^2$ ). Juvenile *Laminaria farlowii* were rare, and two were observed in quadrats,  $0.083/\text{m}^2$ . Miscellaneous red algae were relatively low in abundance covering 4.0% of the bottom. The miscellaneous plants category consisting entirely of filamentous diatoms that were abundant last year, covered only 8.2% of the bottom this year. Encrusting coralline algae covered 61% of the bottom, similar to past years. Foliose algae combined, covered 4% of the bottom, similar to last year. Bare substrate increase from last year to 15% cover.

On RPCs, the most common miscellaneous invertebrates were Christmas tree worms, *Spirobranchus spinosus*, and *Paracyathus stearnsi* (brown cup corals). This category covered 17% of the bottom. *Corynactis californica*, *Balanophyllia elegans*, and *Astrangia lajollaensis* covered 7.2%, 3.5% and 2.8% of the bottom respectively. Similar to past years, *Diopatra ornata* were present in the low-lying sandy areas of the transect, but were rare directly along the transect where they are monitored on RPCs. Bryozoans combined covered 3.8% of the bottom. *Stylaster californica* density was  $0.086/\text{m}^2$ , the highest density recorded for this site. Both large and small *S. californica* colonies were present. The high density recorded this year may have been a result of sampling artifact, as the colonies are aggregated creating high sampling variability. *Lophogorgia chilensis* were abundant as usual with a density of  $0.15/\text{m}^2$ . *Tethya aurantia* density was  $0.031/\text{m}^2$ .

Both *Strongylocentrotus purpuratus* and *S. franciscanus* notably increased from last year and dominate the site. Their densities were recorded at  $51/\text{m}^2$  and  $14/\text{m}^2$  respectively. Juvenile *S. purpuratus* were common, but were not as abundant compared to the more eastern/southern monitoring sites. Similar to previous years, *S. purpuratus* were more abundant on the northern half of the transect. *Lytechinus anamesus* were counted on both quadrats and band transects with densities of  $2.5/\text{m}^2$  and  $3.8/\text{m}^2$  respectively. These are the highest densities recorded on band transects at this site since 1988.

*Asterina miniata* density was recorded at  $0.88/\text{m}^2$ , a increase from last year. *Pisaster giganteus* were counted on both quadrats and 5-meter quadrats, with densities of  $0.17/\text{m}^2$  and  $0.095/\text{m}^2$  respectively. No *Pycnopodia helianthoides* were observed along the transect this year. Similar to last year, *Pachythyone rubra* were common on the northern half of the transect. The *P. rubra* were typically scattered individuals found along the lower relief areas of the transect.

*Cypraea spadicea* density was  $0.63/\text{m}^2$ . *Lithopoma (Astraea) undosum* were notably more abundant and were recorded at the highest density ( $1.7/\text{m}^2$ ) since monitoring began at this site in 1982. *Megathura crenulata* density continued to increase and was recorded at  $0.20/\text{m}^2$ , the highest recorded since 1989. *Kelletia kelletii* did not appear as abundant as last year with a density of  $0.015/\text{m}^2$ . *Aplysia californica* were notably less abundant than last year with a density of  $0.036/\text{m}^2$ . *Crassidoma (Hinnites) giganteus* density was  $0.026/\text{m}^2$ .

Juvenile *Sebastes mystinus* were undoubtedly the most abundant fish along the transect with hundreds observed. Only one adult *S. mystinus* was observed. Juvenile *S. serranoides/flavidus* were common and aggregated around the *M. pyrifera* plants. Juvenile *S. miniatus* were common, but only two observers observed them during the roving diver fish count. Several *Damalichthys vacca*, two *Embiotoca jacksoni*, and one *Hypsypops rubicundus* were observed. Female *Semicossyphus pulcher* were common, and several juveniles were observed. *Oxyjulis californica* were rare. Small painted greenlings, *Oxylebius*

*pictus*, were moderately abundant and large ones were common. *Coryphopterus nicholsii* were moderately abundant in the sandy areas, and their density in quadrats was  $0.96/\text{m}^2$ , the highest recorded since 1990. Two *Alloclinus holderi* were observed in quadrats this year,  $0.083/\text{m}^2$ . No *Lythrypnus dalli* or *L. zebra* were observed during the roving diver fish count, but both were present in small numbers in at least one area along the transect. Roving diver fish count was conducted on June 28<sup>th</sup> with five divers observing 24 species of fish and on August 19<sup>th</sup> with five divers observing 24 species of fish.

All 14 ARMs at this site were intact and in good condition. Five ARMs were monitored for all indicator species, and nine for all but *Strongylocentrotus purpuratus*, *S. franciscanus*, and *L. anamesus*. No *Haliotis* spp. were observed in the ARMs this year. *Cypraea spadicea* densities decreased to 2.6/ARM, about half of last year's density, similar to trends we have observed at other sites. Six small *Megathura crenulata* were found, 0.43/ARM. *Asterina miniata* density in the ARMs was 2.2/ARM, a decrease from last year. *Pisaster giganteus* were rare with only two found (0.14/ARM), this is similar to last year. *Crassedoma* (*Hinnites*) *giganteus* density in the ARMs was 1.1/ARM. The most notable change in the ARMs was the increase in *Strongylocentrotus franciscanus* and *S. purpuratus*, similar to what we have observed at other sites. *S. franciscanus* density was 53/ARM, compared to the 1998 density of 15/ARM. Most of the *S. franciscanus* were less than 25mm, and 68% were less than 15mm. Similarly, *S. purpuratus* densities in the ARMs was 288/ARM, compared to the 1998 density of 47/ARM. Most of the *S. purpuratus* were small, less than 25mm, but only 8.3% were less than 15mm, indicating recruitment over the last two years. *Centrostephanus coronatus* density was 0.86/ARM, slightly higher than last year.

The temperature loggers were working properly and all temperature data was successfully downloaded.

#### **Location: Gull Island North, Santa Cruz Island**

1999 sampling dates: 9/28.

1999 status: purple sea urchin barrens.

We conducted a brief survey dive to search for the Gull Island North site that was installed in 1982, but monitoring was discontinued soon after. We were able to locate several (at least three) of the thread rods where eyebolts used to be attached. We also found at least 50 meters of lead line near the eyebolts, and one of the cemented tires used to mark the ends of the transects. The location of what we thought was the middle of the transect was Latitude: 33 57.160 Longitude: 119 49.660.

The site was almost entirely *Strongylocentrotus purpuratus* barrens with a high density of both adult and small juvenile *S. purpuratus*, and almost no macroalgae.

**Location: Fry's Harbor, Santa Cruz Island**

1999 sampling dates: 8/2, 8/3, 9/16.

1999 status: Open area with high densities of aggregating red sea cucumbers, *Pachythyone rubra* and moderate abundance's of *Astrangia lajollaensis* and *Strongylocentrotus purpuratus*.

Overall, the site appeared similar to past years, and there was no noticeable change during this summer sampling season. There was a moderate abundance of *Pachythyone rubra*, but most were along the inshore portion of the transect. *Strongylocentrotus purpuratus* were moderately abundant and *Astrangia lajollaensis* were abundant as usual for this site.

*Macrocystis pyrifera* was absent, and there continues to be little other brown macro algae at this site. Similar to previous years, several adult *Eisenia arborea* plants were observed on top of the large boulder at the north end of the transect, but none were in quadrats. Brown filamentous diatoms (miscellaneous plants on RPCs) were common, as were some filamentous red algae. Miscellaneous plants and miscellaneous red algae covered 3.0% and 4.8% of the bottom respectively. The algae, *Laurencia pacifica* and *Halicystis ovalis* were common. Only a small amount of *Pachydictyon/Dictyota* was observed. Articulated coralline algae were rare covering only 0.17% of the bottom. Encrusting coralline algae covered 31% of the bottom. Bare substrate cover remained high at 18%.

The most common miscellaneous invertebrates on RPCs were barnacles and hydroids. This category covered 24% of the bottom. For the second year, the brittle star, *Ophiothrix spiculata*, has been relatively rare and none were observed during RPCs. *Astrangia lajollaensis* remained relatively abundant compared to other sites at 12.8%. *Corynactis californica* covered 2.2% of the bottom. Similar to other sites this year, there was notably more *Diaperoecia californica*, and cover was recorded at 2.2%. Miscellaneous bryozoans covered 4.8% of the bottom. *Lophogorgia chilensis* were abundant on the deeper side of the transect, and small individuals were common. They were recorded at their highest density for this site, 0.30/m<sup>2</sup>.

*Pachythyone rubra* cover was similar to last year at 9.3%. Similar to last year, it appears that many of the *P. rubra* may have been just inshore of the transect, and the decrease in abundance observed over the last several years may be due to movement. As mentioned above, no *Ophiothrix spiculata* were observed on RPCs this year. *Parastichopus parvimensis* density remained relatively low for this site at a density of 0.42/m<sup>2</sup>. *Pisaster giganteus* were counted on both quadrats (0.0/m<sup>2</sup>) and 5-meter quadrats (0.05/m<sup>2</sup>). *Asterina miniata* density increased to 0.50/m<sup>2</sup>, an increase from last year when they were recorded at their lowest density (0.042/m<sup>2</sup>) since 1985.

*Strongylocentrotus franciscanus* were recorded at their highest density ( $4.5/\text{m}^2$ ) since sampling began at this site in 1982. *S. purpuratus* were recorded at a density of  $21.3/\text{m}^2$ , a increase from last year, and similar to 1996. No *Centrostephanus coronatus* were observed on quadrats this year, but some were present along the transect. *Lytechinus anamesus* were abundant on the southern end of the transect. Their density was recorded at  $2.0/\text{m}^2$  on band transects. Overall, juvenile *Strongylocentrotus* spp. were less abundant than other sites, but more abundant than last year. No sea star wasting disease or sea urchin wasting syndrome was observed this year.

*Cypraea spadicea* density was  $0.71/\text{m}^2$ . *Lithopoma (Astraea) undosum* density was low at  $0.21/\text{m}^2$ . *Kelletia kelletii* density was  $0.021/\text{m}^2$ , and most were large. *Aplysia californica* were less abundant than last year with a density of  $0.0056/\text{m}^2$ . *Megathura crenulata* density was  $0.068/\text{m}^2$ , and small ones were common. On August 2<sup>nd</sup> we observed several pelagic red crabs, *Pleuroncodes planipes*, during both the day and night at this site.

Adult *Chromis punctipinnis* were abundant and no juveniles were observed on August 2<sup>nd</sup>. Several juvenile *C. punctipinnis* were observed on September 16<sup>th</sup>. Adult *Paralabrax clathratus* were common. Juvenile *Sebastes mystinus* and juvenile *S. carnatus*/*S. caurinus* were relatively abundant on May 12, during a pre-season visit to this site. Female and juvenile *Semicossyphus pulcher* were uncommon and no males were observed. *Damalichthys vacca* were common and several *Rhacochilus toxotes* (rubberlip surfperch) were observed on the northern end of the transect as we have observed in past years. Adult and juvenile *Oxylebius pictus* were common. Stripefin ronquils, *Rathbunella hypoplecta*, were notably rare compared with the past several years at this site, only one was observed this year. *Coryphopterus nicholsii* were noticeably more abundant than last year with a density of  $1.2/\text{m}^2$ . *Alloclinus holderi* were relatively uncommon, and decreased in density from last year's high density to  $0.21/\text{m}^2$ . *Lythrypnus dalli* were extremely abundant and reached their highest density since 1988,  $2.7/\text{m}^2$ . *Lythrypnus zebra* were relatively abundant. Roving diver fish counts were conducted on August 2<sup>nd</sup> with four divers observing 25 species of fish, and on September 16<sup>th</sup> with five divers observing 28 species of fish.

Below the transect at a depth of about 70ft, juvenile *Sebastes saxicola* (stripetail rockfish) and juvenile *S. semicinctus* (halfbanded rockfish) were abundant.

All seven ARMs were intact and sampled for all indicator species. Similar to last year, one *Haliotis corrugata* measuring 22mm was found. The number of *Crassedoma (Hinnites) giganteum* was also similar to last year at 2.9/ARM. *Cypraea spadicea* density in the ARMs was 7.1/ARM. *Megathura crenulata* density was 0.57/ARM, and all were small, less than 56mm. *Pisaster giganteus* remained at low densities with 0.42/ARM. Prior to 1998, they were more abundant. *Asterina miniata* densities were similar to last year with 8.1/ARM. The most notable change in the ARMs was the increase of both

*Strongylocentrotus franciscanus* and *S. purpuratus*. Their densities this year were 52/ARM and 89/ARM respectively, and most were small/juveniles. In 1998, their densities were 17/ARM and 38/ARM respectively. *Centrostephanus coronatus* were more abundant than last year with a density of 1.1/ARM, their highest recorded density at this site.

A Harbor Seal was present on August 2<sup>nd</sup> that was very friendly. It visited almost all of us gently scratching us on the legs and in some cases nibbling at our hoods. I have experienced similar behavior by a Harbor Seal at Fry's Harbor in the past, but have no way of knowing if it was the same seal.

The temperature loggers were working properly and all temperature data was successfully downloaded.

### **Location: Pelican Bay, Santa Cruz Island**

1999 sampling dates: 7/2, 8/3, 10/1.

1999 status: *Strongylocentrotus purpuratus* barren.

The most notable change since last year was the absence of the brown alga, *Acinetospora nicholsoniae* which was abundant last year. Aside from this, the site appeared similar to previous years. There was little macroalgae present. Only a small amount of the brown alga *Colpomenia* sp., and miscellaneous red algae were present at the site. Excluding coralline algae and miscellaneous plants, all algae combined covered only 0.33% of the bottom. The large decrease in the other brown algae category on RPCs was a result in the lack of *A. nicholsoniae* this year. Miscellaneous plants consisting of brown filamentous diatoms covered 4.8% of the bottom. Articulated coralline algae were rare covering only 0.67% of the bottom. Encrusting coralline algae was the dominant algae covering 40% of the bottom. Bare substrate covered 47% of the bottom.

Similar to last year, miscellaneous invertebrates on RPCs were relatively uncommon covering 2.0% of the bottom. Barnacles were the most common miscellaneous invertebrates and were present over most of the site. Similar to last year, terebellid worms were common, but mostly on the deeper side of the transect. *Astrangia lajollaensis* covered 5.5% of the bottom, similar to last year. *Serpulorbis squamigerus* were relatively abundant on the tops of large rocks, however they are typically rare directly along the transect with a cover of 0.50%. Bryozoans were rare directly along the transect, similar to past years. At this site bryozoans are typically more abundant on the steep sides of large rocks, this year they appeared less abundant than last. Most of the *Lophogorgia chilensis* were present on the deeper/offshore side of the transect, and small individuals were common, similar to the last several years. Their density was recorded at 0.10/m<sup>2</sup>, the highest recorded for this site, but not much higher than the last several years.

Although *Strongylocentrotus purpuratus* density has gradually decreased since 1996, they still dominate the site with a density of  $20/\text{m}^2$ . *S. franciscanus* increased in density to  $4.7/\text{m}^2$ , the highest density recorded since 1986. *S. franciscanus* were noticeably more out in the open as opposed to being in crevices than last year. This could be a contributing factor to an increase in density. *Lytechinus anamesus* were abundant on the deeper side of the transect and were counted on both quadrats and 5-meter quadrats with densities of  $5.9/\text{m}^2$  and  $8.7/\text{m}^2$  respectively. These are some of the highest densities recorded for *L. anamesus* since 1987, and in 1998 they were rare, with only two observed along the transect. *Centrostephanus coronatus* density declined from last year to  $0.042/\text{m}^2$ . *Asterina miniata* density was  $0.083/\text{m}^2$ . No *Pisaster giganteus* were observed on quadrats, and on 5-meter quadrats their density was  $0.010/\text{m}^2$ , similar to last year. The sea star, *Linckia columbiae*, was common similar to 1998. *Parastichopus parvimensis* density was  $0.13/\text{m}^2$ . No sea urchin or sea star wasting disease was observed this summer.

*Crassedoma (Hinnites) giganteus* were common with a density of  $0.047/\text{m}^2$ . *Aplysia californica* were relatively uncommon with a density of  $0.0028/\text{m}^2$ , similar to last year. *Lithopoma (Astraea) undosum* were common with a density of  $0.88/\text{m}^2$ . *Kelletia kelletii* density was  $0.029/\text{m}^2$ , and all were large as usual for this site. Two small old abalone shells were found. One was a *Haliotis rufescens* that measured 26mm and the other was a *H. fulgens* measuring 32mm. At least six male sheep crab, *Loxorhynchus grandis* were observed on the deeper side of the transect on July 2<sup>nd</sup>.

Fish appeared more abundant than usual for this site. Most notable were an abundance of Ocean whitefish, *Caulolatilus princeps*. Almost all of these were small, less than 25cm. We observed between 3-6 juvenile *Semicossyphus pulcher*. All of these were an unusual bright orange color. *Lythrypnus dalli* were notably abundant at a density of  $2.5/\text{m}^2$ . This is the highest density recorded since 1991. *Coryphopterus nicholsii* were also more abundant than last year with a density of  $4.3/\text{m}^2$ . *Alloclinus holderi* density declined to  $0.25/\text{m}^2$ . Roving diver fish count was conducted on August 3<sup>rd</sup> with six divers observing 26 species of fish and on October 1<sup>st</sup> with seven divers observing 27 species of fish.

One orange-throated pipe blenny, *Chaenopsis alepidota*, was observed at Pelican Bay, Santa Cruz Island on May 12, 1999. This is possibly a small range-extension for this species.

All six ARMs at this site were intact and sampled for all indicator species. Similar to past years, the ARMs were relatively bare. One *Haliotis corrugata* measuring 29mm was found in an ARM. *Cypraea spadicea* density was 5.5/ARM, slightly lower than last year. *Crassedoma (Hinnites) giganteum* were less abundant than last year with 2.8/ARM. *Asterina miniata* density was similar to last year at 2.0/ARM. Three small *Pisaster giganteus* (0.5/ARM) were found in the ARMs this year, none were found in 1998. *Strongylocentrotus franciscanus* density increased to 42/ARM and most (88%) were less than 25mm. In 1998 *S. franciscanus* density was 17/ARM. *S. purpuratus* did not increase as much, and juveniles were

less abundant relative to other sites. *S. purpuratus* density was 27/ARM, compared to 17/ARM in 1998. *Centrostephanus coronatus* density was 1.5/ARM, a decrease from last year.

No temperature logger was installed at this site in 1998. We installed a temperature logger this year on October 1<sup>st</sup>.

### **Location: Scorpion Anchorage, Santa Cruz Island**

1999 sampling dates: 8/5, 8/6, 9/17, 10/1.

1999 status: *Strongylocentrotus purpuratus* barrens.

This area continues to be a barren, dominated by *Strongylocentrotus purpuratus* and almost completely devoid of macroalgae. The only noticeable macroalgae were small amounts of *Sargassum muticum*, *Desmarestia* sp., and *Dictyota/Pachydictyon* that were scattered around the site. No *Macrocystis pyrifera* was present on the site, but about 100 meters to the east and inshore along the shore around Scorpion anchorage some *M. pyrifera* was present. Miscellaneous plants covered 15% of the bottom and consisted mostly of filamentous brown diatoms; this is the highest cover recorded at this site since monitoring began. Encrusted coralline algae covered 57% of the bottom. Articulated coralline covered 0.33% of the bottom, the lowest cover recorded at this site. Bare substrate covered 15% of the bottom, relatively low compared to previous years.

The most common miscellaneous invertebrates on RPCs were the Christmas tree worm, *Spirobranchus spinosus*, and barnacles, *Balanus* sp.. This category covered 24% of the bottom, a large increase and the most noticeable change at this site since last year. *Serpulorbis squamigerus* were common, covering 1.2% of the bottom. Overall, bryozoans were uncommon directly along the transect, covering 1.0% of the bottom. No *Diaperoecia californica* were observed during RPCs, but they were common on the sides of large rocks of which few are present directly along the transect where RPCs are conducted. *Lophogorgia chilensis* were rare, as usual for this site with only several along the transect, three were observed on band transects (0.0042/m<sup>2</sup>). *Tethya aurantia* density was 0.024/m<sup>2</sup>.

*Strongylocentrotus purpuratus* were abundant with a density of 27/m<sup>2</sup>, similar to last year. *S. franciscanus* were common with a density of 1.3/m<sup>2</sup>, similar to the past four years. Juveniles of *Strongylocentrotus* spp. were rare. *Lytechinus anamesus* were uncommon along the transect and were counted on both band transects and quadrats. Their densities were 0.065/m<sup>2</sup> and 0.042/m<sup>2</sup> respectively. *Strongylocentrotus* spp. were out in the open and not confined to crevices. No sea urchin wasting disease was observed.



*Asterina miniata* were absent on quadrats and only a few were found for size frequencies. This is the first time since 1986 that no *Asterina miniata* were observed in quadrats. *Pisaster giganteus* were rare with none observed on quadrats and 5m-quadrats this year. *Parastichopus parvimensis* remained at its lowest recorded density of 0.083/m<sup>2</sup> for the second consecutive year.

*Aplysia californica* were notably less abundant than last year with a density of 0.021/m<sup>2</sup>. *Megathura crenulata* density was 0.031/m<sup>2</sup>, higher than last year, but still relatively low for this site. Adult and juvenile *Lithopoma (Astraea) undosum* were abundant with a density of 5.4/m<sup>2</sup>, the highest recorded density for this site since monitoring began. This increase in abundance is similar to observations at other sites this year. *Crassedoma (Hinnites) giganteum* were common with a density of 0.069/m<sup>2</sup>. Several *Panulirus interruptus* were observed around the transect, and one was observed on band transects (0.0014/m<sup>2</sup>).

Adult *Chromis punctipinnis*, *Oxyjulis californica*, *Paralabrax clathratus*, female *Halichoeres semicinctus*, and adult and juvenile *Hypsypops rubicundus* were all common. On September 17<sup>th</sup> we observed two juvenile/YOY *Chromis punctipinnis*. Female *Semicossyphus pulcher* were rare, and no males or juveniles were observed this year. *Coryphopterus nicholsii* were common in the soft bottom areas with an overall density of 0.46/m<sup>2</sup>. *Alloclinus holderi* were less abundant than last year, similar to what we have seen at other sites this year. This year's density was 0.25/m<sup>2</sup>. *Lythrypnus dalli* were relatively common for this site, their density was 0.17/m<sup>2</sup>. Zebra gobies, *Lythrypnus zebra* were also relatively common. Similar to past years there was much evidence of predation on *Lithopoma (Astraea) undosum* that was probably from bat rays, *Myliobatis californica* or horn sharks, *Heterodontus francisci*. Several of the latter were observed. Three roving diver fish counts were conducted this year: on August 5<sup>th</sup>, with six divers observing 22 species, on September 17<sup>th</sup> with four divers observing 27 species of fish, and on October 1<sup>st</sup> with six divers observing 27 species of fish.

All seven ARMs were monitored for all indicator species, and three cages were replaced. Similar to past years, the ARMs were relatively bare with few indicator species in them. One *Haliotis fulgens* measuring 28mm was found, indicating some recruitment of this rare abalone. It has been at least ten years since we have heard a report of or observed *H. fulgens* from Santa Cruz Island. *Cypraea spadicea* were less abundant than last year with a density of 10/ARM. *Lithopoma (Astraea) undosum* increased in density to 3.3/ARM, and most were less than 40mm. *Crassedoma (Hinnites) giganteum* density in the ARMs was similar to last year with 5.0/ARM. *Asterina miniata* were rare with only one found (0.14/ARM), similar to last year. Also similar to last year, no *Pisaster giganteus* were observed in the ARMs. Similar to other sites *Strongylocentrotus franciscanus* and *S. purpuratus* greatly increased in the ARMs. Their densities were 9.9/ARM and 34/ARM respectively; in 1998 their densities were 4.2/ARM and 10/ARM respectively. Juveniles of both species were more abundant than last year. *Centrostephanus coronatus* were also more abundant than last year with a density of 0.86/ARM.

The plastic temperature logger housing broke off its stake, however the bolts remain on the stake. We installed new loggers at the site on October 1<sup>st</sup>, 1999

**Location: Yellowbanks, Santa Cruz Island**

1999 sampling dates: 7/19, 7/22, 8/17, 9/13.

1999 status: *Strongylocentrotus purpuratus* barren.

This site has continued to become more barren, and is the most barren we have observed since monitoring began at this site in 1986. There were no *Macrocystis pyrifera*, *Pterygophora californica*, *Eisenia arborea*, *Laminaria farlowii*, or *Cystoseira* spp. present along the transect. This is the first year since monitoring began that none of these algae were present. One juvenile *M. pyrifera* and one juvenile *E. arborea* were observed on top of a rock, east of the transect area. The only algae notably present at this site were a small amount of *Laurencia pacifica*, *Ectocarpus* sp., and some filamentous diatoms. All algae combined covered only 0.5% of the bottom. Miscellaneous plants, consisting of filamentous diatoms, covered 9.3% of the bottom, a decrease from last year. Similar to last year, articulated coralline was rare, covering 2.8% of the bottom. Encrusting coralline covered 51% of the bottom, a large increase from last year, but similar to previous years. Inversely, bare substrate cover decreased to 36%. In 1998 there was a layer of silt covering the substrate at Yellowbanks, and the layer of silt was recorded as bare rock since the silt was typically not thicker than one or two centimeters. This year, most of the silt was gone explaining the increase in incrusting coralline and decrease in bare substrate.

Miscellaneous invertebrates on RPCs covered 4.0% of the bottom. There were no particular species that composed the majority of this category, but some of the most common were hydroids, *Spirobranchus spinosus*, gorgonians, and the small anemone *Sagartia* sp./*Cactosoma* sp.. Bryozoans were rare with miscellaneous bryozoans and *Diaperoecia californica* covering 0.67% and 0.17 of the bottom, respectively. *Tethya aurantia* density continued to increase for the third consecutive year. This years density was 0.069/m<sup>2</sup>, the highest recorded for this site. *T. aurantia* were easy to see due to the lack of algae and silt that has been present in past years. *Lophogorgia chilensis* were abundant for this site and were recorded at the highest density (0.12/m<sup>2</sup>) since 1987. *Muricea californica* and *M. fruticosa* densities were 0.0097/m<sup>2</sup> and 0.0056/m<sup>2</sup> respectively, similar to past years. Similar to last year, tunicates were rare, covering 0.17% of the bottom. Sponges were also rare covering 0.0% of the bottom, their lowest recorded cover at this site.

*Strongylocentrotus franciscanus* and *S. purpuratus* densities were similar to last year, 1.6/m<sup>2</sup> and 14/m<sup>2</sup> respectively. *S. purpuratus* and *S. franciscanus* were out in the open and not confined to crevices.

Several juvenile *Centrostephanus coronatus* were observed and adults were common. *C. coronatus* density was  $0.21/\text{m}^2$ . *Lytechinus anamesus* were relatively abundant and were counted on both quadrats and band transects. Their densities were  $28/\text{m}^2$  and  $17/\text{m}^2$  respectively. During our July and August visit, several *S. purpuratus* and *S. franciscanus* were observed with sea urchin wasting disease.

*Pisaster giganteus* were rare, but more abundant than last year. Densities on quadrats and 5-meter quadrats were  $0.042/\text{m}^2$  and  $0.0050/\text{m}^2$  respectively. *Asterina miniata* densities were  $0.042/\text{m}^2$ , and 19 were found during size frequency measurements. Several *Mediaster aequalis* were observed. *Parastichopus parvimensis* were relatively rare for this site with a density of  $0.13/\text{m}^2$ . No sea star wasting disease was observed this year.

*Lithopoma (Astraea) undosum* density was  $1.6/\text{m}^2$ , the highest recorded for this site. Both large and small individuals were present, but small ones were most common. *Kelletia kelletii* density was  $0.032/\text{m}^2$ . *Megathura crenulata* and *Crassedoma (Hinnites) giganteum* densities were  $0.013/\text{m}^2$  and  $0.015/\text{m}^2$  respectively. No live *Haliotis* spp. were observed during band transects and only two *Haliotis corrugata* were found for size frequencies this year. Both abalone appeared very hungry when offered a piece of brown algae (either *Macrocystis pyrifera* or *Cystoseira* sp). Several small fresh *H. corrugata* shells were found, indicating recent recruitment and mortality. Several octopi were observed along the transect.

Fish were noticeably low in diversity and abundance for this site. Similar to last year, *Coryphopterus nicholsii* and *Paralabrax clathratus* were the most abundant fish. The *P. clathratus* were notably small and almost all appeared below the legal size of 25 cm. *C. nicholsii* density was  $1.3/\text{m}^2$ , the highest recorded density for this fish since 1988. *Alloclinus holderi* were rare, with a density of  $0.083/\text{m}^2$ . Juvenile *Sebastes miniatus* (vermillion rockfish) were relatively abundant and David Kushner counted 46 during the roving diver fish count on July 22, 1999. Several *S. mystinus* were observed. Two adult and two juvenile *S. serriceps* were observed. Juvenile *S. caurinus/carnatus* were relatively abundant on May 12, during a pre-season visit to this site. One *Hypsypops rubicundus*, one *Lythrypnus zebra* and 11 *L. dalli* were observed during the roving diver fish count. *Oxylebius pictus* were common. Several *Alloclinus holderi* were observed but were rare. Small female and juvenile *Semicossyphus pulcher* were observed, however no males were observed during either of the roving diver fish counts. *Oxyjulis californica* were rare, and only a few male and female *Halichoeres semicinctus* were observed. *Chromis punctipinnis* were rare and less than 20 were observed. Roving diver fish count was conducted on July 22<sup>nd</sup> with five divers observing 22 species and on August 17<sup>th</sup> with five divers observing 20 species of fish.

The fifteen ARMs, five at the East, middle and West end of the transect, were all sampled and in excellent condition. Of these, five were sampled for all indicator species, and ten were a sampled for all but *Strongylocentrotus franciscanus*, *S. purpuratus*, and *Lytechinus anamesus*. Eleven ARMs were sampled

for *Centrostephanus coronatus*. Only three ARMs were intact in the group of ARMs east of the east end of the transect, and these were sampled for only *Haliotis* spp. All three of these ARMs need new cages if we are going to continue to maintain and sample them in the future.

One small (18mm) *Haliotis rufescens* and five small (all less than 34mm) *H. corrugata* were found in the 18 ARMs sampled for abalone. *Cypraea spadicea* continued to decline in abundance for the fifth consecutive year. This year's density was 0.93/ARM, the lowest recorded in the ARMs at this site since we began monitoring them in 1992. *Crassedoma (Hinnites) giganteus* were less abundant than last year with 1.1/ARM. *Pisaster giganteus* were less abundant than last year with 0.6/ARM. *Asterina miniata* density in the ARMs was 4.1/ARM, and most were small. This density is similar to the past several years. Octopi were more common than usual in the ARMs.

Juvenile *Strongylocentrotus purpuratus* were extremely abundant in the ARMs. *S. purpuratus* mean density was 335/ARM, and 96% were less than 15mm. *S. franciscanus* density in the ARMs was 39/ARM, similar to last year. Most of the *S. franciscanus* were recent recruits with 84% less than 15mm. *Centrostephanus coronatus* continued to increase in abundance in the ARMs, similar to several other sites. This year the mean was 1.9/ARM.

The temperature loggers were working properly and all temperature data was successfully downloaded.

### **Location: *Pelagophycus porra* forest offshore of Yellowbanks, Santa Cruz Island**

Latitude: 33:59.512      Longitude: 119:31.256

1999 sampling dates: 9/13.

1999 status: *Pelagophycus porra* forest.

We conducted a brief survey dive at a new location off Yellowbanks we thought would have *Pelagophycus porra* at a depth range of 78-92ft. Both adult and juvenile *P. porra* were abundant covering most of the rocky bottom. Understory algae was abundant and diverse consisting mostly of *Laminaria farlowii*, *Pterygophora californica*, *Eisenia arborea*, *Cystoseira* sp., *Agarum fimbriatum*, encrusting and articulated coralline algae. The ostrich plume hydroid, *Aglaophenia latirostris*, was abundant. No live *Haliotis sorenseni* or shells were found. Among all (six) of the divers we observed 10 live *H. rufescens*, and no *H. corrugata*. *H. rufescens* shells were common, and *H. corrugata* were less so. One fresh *H. assimilis* shell was found. Small (50-70mm) *Kelletia kelletii* were common.

*Chromis punctipinnis* and *Oxyjulis californica* were the most abundant fish. *Paralabrax clathratus*, male and female *Semicossyphus pulcher* were common. *Scorpaena guttata* were common on the bottom. Adult *Sebastes atrovirens* were moderately abundant and often in small groups (2-8 fish).

**Location: East side of Pelican Bay, Santa Cruz Island**

1999 sampling dates: 9/16.

1999 status: Rich soft bottom community.

We conducted a brief survey dive here at a depth of about 40ft at the outer edge of Pelican Bay. Geoduck clams, *Panopea generosa*, were common over most of the area, and abundant with an estimation of several per square meter in areas of their highest density. There were patches of soft bottom that had moderate abundance of *Ophiothrix spiculata*. Several areas had moderate densities of Mantis shrimp, *Hemisquilla ensigera californiensis*. Small flatfish of at least three species were abundant.

**Location: About 1000 meters west of Cavern Point, Santa Cruz Island**

1999 sampling dates: 9/17.

1999 status: We covered a large area that had a variety of cover, but included *Ophiothrix spiculata* barrens, *Strongylocentrotus purpuratus* barrens, and bare rock. Most of the area was devoid of macroalgae.

We conducted a brief survey dive just west of Cavern Point. We began the dive at about 23 m in soft bottom and swam towards the east several 100 meters, ending up at a depth of about 18 m. At a depth of about 23 m, the soft bottom was about 50-100% covered by the brittle star, *Ophiothrix spiculata*. Rock substrate began at a depth of about 13 m. Most of this area had little macroalgae and a moderate abundance of *Strongylocentrotus purpuratus*.

We counted seven abandoned (none had buoy lines) lobster traps on the bottom, all were open and not actively fishing.

**Location: Admiral's Reef, Anacapa Island**

1999 sampling dates: 6/18, 8/16, 8/17.

1999 status: *Strongylocentrotus purpuratus* and *Ophiothrix spiculata* (brittle star) barrens.

This site continued to be mostly a barren, dominated by *Strongylocentrotus purpuratus* and *Ophiothrix spiculata*. However, *S. franciscanus* were also moderately abundant. For the last several years, *Macrocystis pyrifera* was present along the western 30 meters of the transect, this year there was none along the entire transect. Adult, subadult, and juvenile *M. pyrifera* densities were all 0.0/m<sup>2</sup>, and cover on RPCs was 0.0%. *Eisenia arborea* continued to decline in abundance along the transect and no *E. arborea* were observed in quadrats and cover was recorded at 0.33%. Several adult and juvenile *E. arborea* plants were present along the transect, usually on the top of high relief areas. No *Pterygophora californica*, *Laminaria farlowii*, or *Cystoseira* spp. were observed along the transect. *Agarum fimbriatum* was also absent from the site. Miscellaneous brown and red algae covered 0.33% and 11% respectively. Miscellaneous plants covered 11% of the bottom and consisted of filamentous diatoms. Articulated and encrusting coralline algae covered 0.17% and 42% of the bottom respectively. Bare substrate covered 27% of the bottom. Cobble substrate decreased to 3%, while sand increased to 11% cover. These substrate changes were almost an inverse of the 1998 cover.

The kelp forest located just inshore of the transect, on top of the reef, had noticeably less *M. pyrifera* and understory algae. Patches of *Gelidium purpurescens* and *Cystoseira* sp. were present, but not as abundant as in 1998. Both *Strongylocentrotus franciscanus* and *S. purpuratus* dominated most of the area on the upper reef. *S. purpuratus* abundance appeared higher than last year. Sea urchin fronts (small areas with high densities of sea urchins that appear to be moving in a particular direction) were present, often surrounding the holdfasts of the few remaining *M. pyrifera* plants in this area. It appears that there will be little algae on this upper reef if sea urchin densities remain high.

Similar to the last several years the most common miscellaneous invertebrates encountered on RPCs were *Ophiothrix spiculata*, *Spirobranchus spinosus*, hydroids, and gorgonians (mostly purple gorgonians, *Eugorgia rubens*). *Ophiothrix spiculata* was counted separately and then added to the miscellaneous category on RPCs. Miscellaneous invertebrates covered 30.1% of the bottom; 10.5% were *O. spiculata*, and the remaining 19.6% were other invertebrates. The cover of *O. spiculata* was similar to last year. As usual, *Eugorgia rubens* were abundant along the transect. On June 18<sup>th</sup>, many of the *E. rubens* were overgrown with filamentous diatoms, however on August 16th there appeared to be less growth on them. *Lophogorgia chilensis*, *Muricea fruticosa*, and *M. californica* were all relatively common with densities of 0.15/m<sup>2</sup>, 0.0083/m<sup>2</sup> and 0.038/m<sup>2</sup> respectively. This was the highest density recorded for *L. chilensis* since monitoring began at this site. *Corynactis californica* and *Astrangia lajollaensis* were common, covering 2.0% and 3.8% of the bottom respectively. Bryozoans combined covered 1.2% of the bottom.

Similar to the last three years, *Strongylocentrotus purpuratus* and the brittle star, *Ophiothrix spiculata*, dominated the eastern 2/3rds of the transect, and *S. franciscanus* was more abundant along the western

third of the transect. *Strongylocentrotus franciscanus* density was similar to past years at 8.8/m<sup>2</sup>. *Strongylocentrotus purpuratus* density increased to 66/m<sup>2</sup>, the highest density recorded at this site since monitoring began. Many of the *S. purpuratus* counted in quadrats were juveniles, <15 mm. Juvenile *S. franciscanus* were common, but noticeably less abundant than *S. purpuratus*. *Ophiothrix spiculata* abundance was similar to last year as mentioned above. *Lytechinus anamesus* increased in density and were counted on quadrats and band transects. Their densities were 3.5/m<sup>2</sup> and 1.4/m<sup>2</sup> respectively, and were at the highest densities recorded since 1992. *Centrostephanus coronatus* were relatively abundant with both adult and juveniles present. Their density was recorded at 3.2/m<sup>2</sup>; the highest recorded since we began monitoring this species in 1996. On June 18<sup>th</sup> we observed a few *S. purpuratus*, *S. franciscanus*, and *L. anamesus* with wasting disease. On August 16<sup>th</sup>, there were notably more *S. franciscanus* and *S. purpuratus* with wasting disease with an estimated 10% prevalence in some areas. Two *Arbacia incisa* were observed in the ARMs.

*Pisaster giganteus* continued to be rare with none observed on quadrats and 5-meter quadrats (0.0/m<sup>2</sup>). *Asterina miniata* density remained low at 0.21/m<sup>2</sup>, similar to last year. *Parastichopus parvimensis* density was similar to last year at 0.88/m<sup>2</sup>. No sea star wasting disease was observed this year.

*Crassedoma (Hinnites) giganteus* density was 0.056/m<sup>2</sup>, and were more common on the steep inshore side of the transect. *Megathura crenulata* density was low at 0.0056/m<sup>2</sup>. Similar to other sites this year, *Aplysia californica* were less abundant than last year. This year *A. californica* density declined to 0.060/m<sup>2</sup>. *Kelletia kelletii* density was 0.017/m<sup>2</sup>. One *Haliotis corrugata* was observed during band transects (0.0014/m<sup>2</sup>). During *Haliotis spp.* size frequency measurements we could not locate this abalone again, and no other abalone were found within the transect area. One *H. corrugata* was observed in the shallower areas above the transect. Two *Panulirus interruptus* were found during band transects (0.0028/m<sup>2</sup>). The pencil oyster, *Pteria sterna*, were common growing on *Eugorgia rubens* and *Lophogorgia chilensis*. The *P. sterna* were notably larger than last year when they first appeared in relatively high numbers. The snail, *Simnia Delonovola aequalis*, were common. Juvenile *Tegula regina* were common in the ARMs.

Fish did not appear as diverse and/or abundant as in previous years at this site. Small *Chromis punctipinnis* were abundant. There were noticeably fewer large *C. punctipinnis* observed on August 16<sup>th</sup> than on June 18<sup>th</sup>. Juvenile *Sebastes mystinus* were abundant. David Kushner counted 111 juvenile *S. mystinus* during the roving diver fish count on June 18<sup>th</sup>, however none were counted on fish transects on the same date. Most of the juvenile *S. mystinus* were estimated to be 6cm in length. On June 18<sup>th</sup> we observed at least nine juvenile *S. miniatus*, however on August 16<sup>th</sup>, only three were observed. Most of the *S. miniatus* were observed at the deeper areas of the transect. Adult *Sebastes serriceps* were common. Small female *Semicossyphus pulcher* were common, several males were observed, and

juveniles were common with at least four observed during a roving diver fish count in June. *Oxyjulis californica* were relatively uncommon and were observed grooming the *Chromis punctipinnis*. Female *Halichoeres semicinctus* were common. Small *Oxylebius pictus* were common, but larger ones were rare. *Coryphopterus nicholsii* density was  $1.6/\text{m}^2$ . *Alloclinus holderi* remained relatively abundant at a density of  $0.67/\text{m}^2$ . Roving diver fish count was conducted on June 18<sup>th</sup> with four divers observing 19 species of fish and on August 16 with five divers observing 21 species.

During our June 18<sup>th</sup> visit to this site, white spots or blemishes on the *Chromis punctipinnis* were common and we believe these are from a bacterial infection. Several of the *C. punctipinnis* were observed with large pits or holes, which we assumed were caused by this infection. During our second visit on August 16<sup>th</sup>, there were noticeably less *C. punctipinnis* with white spots compared to our earlier visit. Five of the seven ARMs were intact enough to be sampled. One ARM was in disarray with its cage missing, and the other was falling apart. Both of these ARMs were repaired and a new cage with the tag #2443 was used to replace the one that was missing. Two ARMs were monitored for all indicator species. Each of these took more than one dive with two people to sample due to the large number of juvenile *Strongylocentrotus purpuratus*.

Similar to past years, no *Haliotis* spp. were observed in the ARMs. *Cypraea spadicea* abundance decreased from last year to  $1.2/\text{ARM}$ . *Crassidoma* (*Hinnites*) *giganteum* abundance increased from last year with  $4.8/\text{ARM}$ . *Asterina miniata* abundance in the ARMs was similar to last year at  $9.6/\text{ARM}$ . Only one small *Pisaster giganteus* was found in the five ARMs ( $0.2/\text{ARM}$ ). The abundance of *Strongylocentrotus franciscanus* continued to increase for the second consecutive year. This years density was  $58/\text{ARM}$ , and 50% were less than 15mm. The number of *S. purpuratus* in the ARMs increased dramatically. In the two ARMs sampled for urchins, the mean density of *S. purpuratus* was  $484/\text{ARM}$ , compared with last years density of  $26/\text{ARM}$ . Most of the *S. purpuratus* were juveniles with almost 96% under 15mm, and the majority of these were less than 5mm. *Centrostephanus coronatus* were abundant in the ARMs with  $4.2/\text{ARM}$ , similar to last year.

The temperature loggers were successfully retrieved and deployed. The StowAway temperature logger was consistently reading 1-1.5 C° higher than the HoboTemp temperature logger. Both loggers were sent to Onset Corp. for calibration and testing. The HoboTemp logger was reading about 1 C° lower than the ambient temperature, so only the data from the StowAway logger was used.

### **Location: Cathedral Cove, Anacapa Island**

1999 sampling dates: 7/23, 8/5, 9/27.

1999 status: Kelp Forest.



*Macrocystis pyrifera* canopy cover was estimated to cover 50% of the transect on August 5<sup>th</sup>, an increase from last year. Adult, subadult, and juvenile *M. pyrifera* densities were 0.01/m<sup>2</sup>, 0.62/m<sup>2</sup>, and 1.7/m<sup>2</sup> respectively, and bottom cover was 27%. The densities of subadults and juveniles are both increases from last year's lowest recorded densities. Adult *M. pyrifera* density from 5-meter quadrats decreased while they increased on quadrats since last year. Note, that the definitions of these adult *M. pyrifera* in the two sampling protocols are different (Davis et. al. 1999). Overall, *M. pyrifera* density increased from last year, but it does appear from the data that the large mature plants continued to senesce after the 1998 field season and have been replaced by smaller subadults.

Adult and juvenile *Laminaria farlowii* densities were 0.0/m<sup>2</sup> and 0.42/m<sup>2</sup> respectively, and cover was recorded at 1.5%. *Cystoseira* Spp. covered 5.5% of the bottom, and was more abundant than last year when cover was it's lowest since 1990. Miscellaneous brown algae (mostly *Dictyota/Pachydictyon*) covered 23% of the bottom, the highest cover recorded since 1990. Miscellaneous plants covered 14% of the bottom, a decrease from last year, but still relatively high for this site. This category consisted entirely of the filamentous brown diatoms. Articulated and encrusting coralline algae covered 28% and 59% of the bottom respectively. Bare substrate covered 6.7% of the bottom, a decrease from last year and the lowest recorded since 1985.

Similar to past years, the most common miscellaneous invertebrates on RPCs were *Spirobranchus spinosus*. This category covered 20% of the bottom, an increase from last year. Bryozoans were more abundant than last year, combined they covered 7.5% of the bottom. Gorgonians are rare at this site, but are abundant just north of the site around the point where there is typically more current. One *Lophogorgia chilensis* was observed on in band transects (0.0014/m<sup>2</sup>).

*Strongylocentrotus franciscanus* and *S. purpuratus* densities were 5.3/m<sup>2</sup> and 1.9/m<sup>2</sup> respectively, similar to past years. *Centrostephanus coronatus* were relatively common for this site with a density of 0.21/m<sup>2</sup>, their highest density recorded since we began monitoring this species in 1996. Emergent *Asterina miniata* were rare with a density of 0.083/m<sup>2</sup>. Similar to previous years, juvenile *A. miniata* were common under rocks and relatively abundant in the ARMs. *Pisaster giganteus* were rare, and none were encountered on 5-meter quadrats and quadrats. *Parastichopus parvimensis* density remained high at 1.9/m<sup>2</sup>, the highest recorded density for this site, but similar to 1998.

Adult and juvenile *Lithopoma (Astraea) undosum* were notably abundant with a density of 10.4/m<sup>2</sup>, the highest density recorded at this site since monitoring began in 1982. *Crassedoma (Hinnites) giganteum* were abundant along the steep areas on the inshore side of the transect and had a density of 0.12/m<sup>2</sup>. *Aplysia californica* density was 0.0069/m<sup>2</sup>, noticeably less than 1998, but similar to 1997. Five *Haliotis*

*corrugata* were observed on band transects (0.0069/m<sup>2</sup>). *Panulirus interruptus* density remained relatively low for this site at 0.0069/m<sup>2</sup>.

*Girella nigricans*, *Paralabrax clathratus*, adult *Chromis punctipinnis*, adult *Embiotoca jacksoni*, adult and juvenile *Hypsypops rubicundus*, male and female *Halichoeres semicinctus* and female *Semicossyphus pulcher* were all common along the transect. No male *S. pulcher* were observed, and juveniles were rare. At least one tagged (but possibly two) *Hypsypops rubicundus* were observed this year, these were tagged in the early 1980's. Several adult and juvenile *Sebastes atrovirens* were observed, but were rare overall. *Coryphopterus nicholsii* were uncommon with a density of 0.13/m<sup>2</sup>. *Alloclinus holderi* density was 1.1/m<sup>2</sup>, a decrease from last year. The roving diver fish count was conducted on August 5<sup>th</sup> with six divers observing 23 species and on September 27<sup>th</sup> with seven divers observing 25 species.

It appeared that the ARMs had moved little since last year and all seven were intact. Five ARMs were sampled for all indicator species, one for all but *Strongylocentrotus purpuratus* and *S. franciscanus*, and one for all but *S. purpuratus*, *S. franciscanus*, and *Centrostephanus coronatus*.

Four small (all were less than 34mm) *Haliotis corrugata* were found this year, a density of 0.57/ARM. The number of *Crassedoma (Hinnites) giganteum* in the ARMs increased from last year to 4.0/ARM. *Cypraea spadicea* density was 9.7/ARM. *Lithopoma (Astraea) undosum* density was 0.57/ARM. This was a decrease from last year, however, densities on quadrats increased dramatically. This is indication that the ARMs are not good indicators of *L. undosum* populations. These snails appear to prefer open areas as opposed to interstitial spaces such as provided by the ARMs. *Asterina miniata* and *Pisaster giganteus* were more abundant than last year with densities of 11/ARM and 1.4/ARM respectively, and were mostly small with mean sizes of 25mm and 29mm respectively. *Strongylocentrotus franciscanus* and *S. purpuratus* abundance greatly increased this year to 73/ARM and 133/ARM respectively. Their 1998 densities were 24/ARM and 44/ARM respectively. Unlike last year, juveniles of both species were relatively abundant. *Centrostephanus coronatus* were relatively abundant, but similar with 1.7/ARM.

The temperature loggers were working properly and all temperature data was successfully downloaded.

### **Location: Landing Cove, Anacapa Island**

1999 sampling dates: 8/4, 8/20, 9/27.

1999 status: Open kelp forest.

*Macrocystis pyrifera* canopy cover was low and estimated at 10%. Lack of canopy cover is not uncommon at this site due to heavy boat traffic in the Cove. Adult, subadult and juvenile *M. pyrifera* densities were 0.02/m<sup>2</sup>, 0.89/m<sup>2</sup>, and 7.1/m<sup>2</sup> respectively, and covered 34% of the bottom. This was the

highest density of juvenile *M. pyrifera* since 1986. Overall, understory algae were abundant. Adult and juvenile *E. arborea* densities were  $0.83/\text{m}^2$  and  $0.21/\text{m}^2$  respectively, and covered 19% of the bottom. Most of the *E. arborea* were on top of the shallow reef area on the east end of the transect, typical for this site. Adult and juvenile *Laminaria farlowii* densities were  $0.042/\text{m}^2$  and  $5.5/\text{m}^2$  respectively, and covered 4.5% of the bottom. Adult and juvenile *Pterygophora californica* densities were  $0.0/\text{m}^2$  and  $0.54/\text{m}^2$  respectively and covered 0.17% of the bottom. Miscellaneous brown algae covered 8.3% of the bottom. *Cystoseira* spp. covered 9% of the bottom. *Gelidium* spp. (mostly *G. purpurescens*) cover was 23%. All of the *Gelidium* spp. was on top of the reef at the eastern end of the transect. Miscellaneous plants covered 8.5% of the bottom. Articulated and encrusting coralline algae covered 19% and 73% of the bottom, respectively. This was the highest cover for encrusting coralline algae since 1985. Bare substrate covered 9%, which is less than the previous nine years.

The most common miscellaneous invertebrates on RPCs were hydroids. This category covered 11% of the bottom. Bryozoans combined covered 16% of the bottom, an increase from last year. Bryozoans were common covering the *Gelidium* spp. as in past years. Tunicates, and *Corynactis californica* were mostly on the shallow/eastern end of the transect, and covered 0.7% and 4.0% respectively.

*Asterina miniata* were rare as usual for this site with none ( $0.0/\text{m}^2$ ) observed in quadrats this year, however they were common in the ARMs (see section on ARMs below). *Pisaster giganteus* were also rare and were counted on both quadrats and 5-meter quadrats; their densities were  $0.0/\text{m}^2$  and  $0.0050/\text{m}^2$  respectively. *Strongylocentrotus franciscanus* and *S. purpuratus* were common, with densities of  $3.7/\text{m}^2$  and  $2.9/\text{m}^2$  respectively, similar to past years. *Parastichopus parvimensis* density was  $0.42/\text{m}^2$ , similar to previous years. No sea star wasting disease or sea urchin wasting syndrome was observed at this site this year.

*Lithopoma (Astraea) undosum* were relatively abundant with a density of  $3.3/\text{m}^2$ , the highest recorded at this site since monitoring began. *Crassedoma (Hinnites) giganteum* were abundant along the vertical walls as is usual for this site, their density was  $0.29/\text{m}^2$ . *Aplysia californica* were rare and none were observed during band transects,  $0.0/\text{m}^2$ . *Halotis corrugata* density continued to decline, this year's density was  $0.0056/\text{m}^2$ , and is the lowest recorded at this site since monitoring began in 1982. A good search effort was made for *H. corrugata* size frequency measurements within the transect area, only 12 were found, similar to last year.

Adult *Chromis punctipinnis*, adult and juvenile *Hypsypops rubicundus*, adult *Paralabrax clathratus*, adult *Medialuna californiensis*, and adult *Girella nigricans* were all common, especially on top of the reef at the eastern end of the transect. Several of the *P. clathratus* were notably large, but it appeared that there were fewer large *P. clathratus* this year than in the past. Several female, and one male *Semicossyphus pulcher* were observed. Juvenile *S. pulcher* were rare. *Coryphopterus nicholsii* were common in the deeper sandy

areas of the transect; only one was observed in quadrats ( $0.042/\text{m}^2$ ). *Alloclinus holderi* density was  $0.75/\text{m}^2$ . This is a decline from last year's highest recorded density of  $1.8/\text{m}^2$ . *Lythrypnus dalli* and *Lythrypnus zebra* were relatively abundant along the wall, several meters from the transect line. However no *L. dalli* were observed directly along the transect where they are counted in quadrats. On August 4<sup>th</sup>, one black sea bass, *Stereolepis gigas*, was observed. Roving diver fish counts were conducted on August 4<sup>th</sup> with six divers observing 24 species and on September 27<sup>th</sup> with seven divers observing 24 species.

We actively searched for the Guadalupe cardinal fish, *Apogon guadalupensis*, which were observed last year, and none were found.

All seven ARMs were intact. Four ARMs were monitored for all indicator species, two ARMs for all but *Strongylocentrotus franciscanus* and *S. purpuratus*, and one ARM for all but *S. franciscanus*, *S. purpuratus*, and *Centrostephanus coronatus*.

One *Haliotis fulgens* measuring 20mm was observed in a ARM. No other *Haliotis* spp. were observed in the ARMs. Two small (<40mm) *Kelletia kelletii* were found in the ARMs. *Crassedoma (Hinnites) giganteum* abundance in the ARMs was 3.3/ARM, and most were small (<30mm). *Cypraea spadicea* density was 3.6/ARM. *Asterina miniata* were more abundant than last year, with 6.3/ARM and most were less than 20mm. *Pisaster giganteus* were more abundant than the last two years. Their density this year was 1.4/ARM and all were less than 60mm. *Strongylocentrotus franciscanus* continued to increase for the second year; this year's density was 125/ARM. Most were small, with 45% less than 15mm, though this was a lower percentage than in 1998. *S. purpuratus* also increased in abundance from last year. Their density was 169/ARM, and 57% of these were less than 15mm. *Centrostephanus coronatus* were relatively abundant, similar to last year with 4.0/ARM.

The temperature loggers were working properly and all temperature data was successfully downloaded.

### **Location: Southeast Sea Lion, Santa Barbara Island**

1999 sampling dates: 6/15, 6/16, 8/18.

1999 status: *Strongylocentrotus purpuratus* and *S. franciscanus* barrens.

This site continues to be a sea urchin barren, dominated by *Strongylocentrotus purpuratus*, and *S. franciscanus*, but also relatively high densities of *Centrostephanus coronatus*. Similar to last year, macroalgae continued to be virtually absent along the transect. No algae were observed on quadrats, and no *M. pyrifera* was observed along the entire transect this year. Excluding coralline algae, algae combined covered 2.8% of the bottom. Other plants, mostly filamentous diatoms covered 0.83% of the

bottom, a decline from the past two years. Encrusting coralline algae were abundant covering 64% of the bottom. Articulated coralline algae were rare, covering only 0.33% of the bottom. Bare substrate covered 14% of the bottom.

The miscellaneous invertebrate category on RPCs covered 23% of the bottom, higher than the last several years. Similar to last year, the most common miscellaneous invertebrates were a small unidentified anemone believed to be *Cactosoma arenaria* or *Sagartia catalinensis*, hydroids and gorgonians. *C. arenaria*/*S. catalinensis* were more abundant along the northern half of the transect. *Corynactis californica* covered 2.3% of the bottom. *Balanophyllia elegans* and *Astrangia lajollaensis* covered 0.50% and 3.8% of the bottom respectively. Tunicates were notably less abundant than last year, with a cover of 2.2%. Bryozoans covered 0.50%. *Tethya aurantia* were abundant with a density of  $0.15/\text{m}^2$ , similar to last year. *Lophogorgia chilensis* were relatively abundant with a density of  $0.22/\text{m}^2$ . Small *L. chilensis* (<15cm in height) were abundant, similar to last year. As usual for this site, *Muricea californica* were common, while *M. fruticosa* were less common. Their densities were  $0.026/\text{m}^2$  and  $0.011/\text{m}^2$  respectively. The temperature logger housing was approximately 75% covered by the bryozoan, *Bugula californica*.

*Strongylocentrotus purpuratus* densities have been decreasing the previous three years. This year they increased almost 75% to a density of  $35/\text{m}^2$ . Similarly, *S. franciscanus* densities have been decreasing over the past four years, this year they increased almost 750% to  $10/\text{m}^2$ ; this is the highest recorded density at this site since monitoring began in 1982. It is typical for divers conducting quadrats not to see sea urchins smaller than about 8mm. These small urchins are often covered with sand and unless one is specifically looking for them, they are ignored during the quadrat counts. Two divers estimated the number of these small urchins, each counting in one square meter quadrat. David Kushner counted 1,350 in one of the quadrats and Barbara Hajduczek estimated between 1,160 – 3,000 in another quadrat. From the quadrats a sub-sample of about 200 small urchins were brought to the surface for identification. All were *S. purpuratus*, and most were between 1-4mm with the largest in this sub-sample at 11mm. *Lytechinus anamesus* were more abundant than last year. As usual, these were difficult to see because they were covered with pebbles and/or shell fragments. They were counted on both quadrats and band transects with densities of  $5.5/\text{m}^2$  and  $3.0/\text{m}^2$  respectively. The three species of sea urchins mentioned above were mostly out in the open and not confined to crevices. *Centrostephanus coronatus* were relatively abundant with a density of  $2.5/\text{m}^2$ . This is the highest density recorded since we began monitoring them in 1996.

*Arbacia incisa* were also counted in quadrats this year, but this data was not added to the database. Their density was  $0.25/\text{m}^2$  and the raw data is below:

<b>Arbacia incisa count A</b>	0	0	1	0	1	0	0	0	0	0	0	0
<b>Quadrat #</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>
<b>Arbacia incisa count B</b>	1	0	0	1	1	1	0	0	0	0	0	0

*Asterina miniata* density was  $0.25/\text{m}^2$ . *Pisaster giganteus* densities were  $0.083/\text{m}^2$  and  $0.075/\text{m}^2$  on quadrats and 5-meter quadrats respectively. *Parastichopus parvimensis* were common with a density of  $0.79/\text{m}^2$ . The brittle star, *Ophiothrix spiculata* were present at the site, but not very abundant. No sea star wasting disease was observed. Sea urchin wasting disease was observed in two *Lytechinus anamesus* on August 18<sup>th</sup>.

Similar to other sites, *Lithopoma (Astraea) undosum* were relatively abundant. Their density was  $4.9/\text{m}^2$ , the highest density recorded at this site since monitoring began in 1982. *Kelletia kelletii* were rare with none observed on band transects this year. *Megathura crenulata* were rare with a density of  $0.0056/\text{m}^2$ . No live *Haliotis spp.* were observed this year. This is the fifth consecutive year that no live *Haliotis spp.* were found along the transect. Several large old *H. corrugata* shells were present, but not collected. *Aplysia californica* were notably less abundant than last year; this years density was  $0.11/\text{m}^2$ . The turban snail, *Tegula eiseni* was common. The opisthobranch, *Navanax inermis*, was common. The Pacific wing oyster, *Pteria sterna*, which usually grows on gorgonians, was common and most were notably larger than last year. Both species of coffee bean snails, *Trivia solandri* and *T. californica* were common. Several octopi were observed, and appeared more abundant than usual.

Fish diversity was higher this year than last year at this site. The most notable fish were juvenile *Sebastes mystinus* and *S. miniatus*. During the roving diver fish count David Kushner counted more than 45 *S. mystinus* and 28 *S. miniatus*. The *S. miniatus* appeared evenly spaced around the transect as if they had separate territories. Other than the two rockfish mentioned above, and *Alloclinus holderi* and *Chromis punctipinnis*, most of the other fish species were present in low numbers. *Hypsypops rubicundus* were common, but no juveniles were observed. Female *Semicossyphus pulcher* did not appear to be as abundant as last year, and only several juveniles and one small male were observed. Bat rays, *Myliobatis californica*, were common with over 15 observed at one time, but only several were observed during the roving diver fish counts. *Lythrypnus dalli* were rare at  $0.042/\text{m}^2$ . *Coryphopterus nicholsii* density continued a gradual decline, and was recorded at  $0.17/\text{m}^2$ , the lowest density recorded since 1987. *Alloclinus holderi* were still relatively abundant for this site, but continued to decline for the second consecutive year. Their density was recorded at  $0.88/\text{m}^2$ . The roving diver fish count was conducted on June 15<sup>th</sup> with five divers observing 18 species, and on August 18<sup>th</sup> with six divers observing 20 species.

The temperature loggers were working properly and all temperature data was successfully downloaded.

**Location: Arch Point, Santa Barbara Island**

1999 sampling dates: 6/15, 6/16, 8/18.

1999 status: *Strongylocentrotus purpuratus* barren.

Overall, there was less *Macrocystis pyrifera* and more *Strongylocentrotus purpuratus* than at the end of the 1998 sampling season. The only adult *M. pyrifera* plants within the transect area were several plants nearly 10 meters off the inshore side of the transect line. Several other adult *M. pyrifera* plants were present outside of the transect area. Juvenile *M. pyrifera* were common on the inshore side of the south end of the transect. Most of these were growing epiphytically on the *Sargassum muticum* plants that appeared to be senescing. Adult, subadult and juvenile *M. pyrifera* densities were recorded at 0.0/m<sup>2</sup>, 0.005/m<sup>2</sup> and 0.042/m<sup>2</sup> respectively. *M. pyrifera* was the only macro algae recorded on quadrats. No *M. pyrifera* was recorded on RPCs. *Pterygophora californica*, *Laminaria farlowii*, and *Eisenia arborea* were all absent from the site. Other than coralline algae, the most abundant algae were *Laurencia pacifica* and *Gelidium purpureum*. These were mostly growing on the tops of rocks. The green algae, *Codium setchellii* was common. Green algae covered 0.67% of the bottom and consisted only of this species. Miscellaneous red algae cover was 8.7%. Miscellaneous plants, mostly filamentous diatoms covered 9.0% of the bottom. Articulated coralline algae was notably less abundant than last year covering 5.3% of the bottom. Encrusting coralline algae 62% of the bottom. Bare substrate was recorded at a cover of 7.3%, the lowest recorded at this site.

Similar to last year, the most common miscellaneous invertebrates on RPCs were hydroids and *Spirobranchus spinosus*. This category covered 16% of the bottom, similar to last year. *Phragmatopoma californica* continued to increase for the second year and was most abundant along the southern half of the transect. This year it covered 12% of the bottom, the highest cover since 1985. It appears that the years *P. californica* is abundant at this site are after major El Niño events. *Corynactis californica* remained relatively uncommon covering 1.3% of the bottom. Tunicates were notably less abundant than last year covering 0.83% of the bottom. No sponges were observed on RPCs this year. Miscellaneous bryozoans were more abundant than last year covering 5.8% of the bottom. Misc. bryozoans consisted mostly of *Thalamoporella californica* that was present on the tops of rocks. *Lophogorgia chilensis*, *Muricea fruticosa*, and *M. californica* were all present, but uncommon with densities of 0.0028/m<sup>2</sup>, 0.0/m<sup>2</sup>, and 0.0/m<sup>2</sup> respectively.

*Strongylocentrotus purpuratus* ended its three years of decline and dramatically increased to a density of 50/m<sup>2</sup>, up from 19/m<sup>2</sup> in 1998. Similar to Southeast Sea Lion, small *S. purpuratus*, less than 10mm, were

abundant. While conducting quadrats divers often do not observe sea urchins less than about 8mm. These small urchins are almost always covered with sand and unless one is specifically looking for them, they are ignored during the quadrat counts. We did not estimate the density of these small sea urchins as we did at Southeast Sea Lion, and in some areas the densities appeared similar, but were more patchily distributed. Similar to Southeast Sea Lion, *S. franciscanus* increased almost 500% to 14/m<sup>2</sup>, up from 2.9 in 1998. Like Southeast Sea Lion, this is the highest density recorded for this site since monitoring began in 1982. *S. purpuratus* were observed feeding on the few *M. pyrifera* holdfasts present in the shallow areas above the transect. *Lytechinus anamesus* were recorded at a density of 1.6/m<sup>2</sup>, their highest density since 1987. *Centrostephanus coronatus* density was similar to last year at 0.79/m<sup>2</sup>. No sea urchin wasting syndrome was observed at this site this summer.

*Asterina miniata* were notably more common than last year, and had a density of 0.083/m<sup>2</sup>. *Pisaster giganteus* were present in low numbers and were counted on both quadrats and 5-meter quadrats with densities of 0.0/m<sup>2</sup> and 0.065/m<sup>2</sup> respectively. During size frequencies we located 33 *A. miniata* and 35 *P. giganteus* for measurement. *Parastichopus parvimensis* density was 0.13/m<sup>2</sup>. No sea star wasting disease was observed.

*Aplysia californica* were notably less abundant than the last several years. This years density was 0.067/m<sup>2</sup>, the lowest since 1994. Similar to Southeast Sea Lion, *Lithopoma (Astraea) undosum* increased over 2000% to a density of 9.0/m<sup>2</sup>, the highest ever recorded at this site. *Crassedoma (Hinnites) giganteus* were common with a density of 0.015/m<sup>2</sup>. One fresh *Haliotis corrugata* shell measuring 25mm was found. The turban snails, *Tegula aureotincta*, and *T. eiseni* were moderately abundant. The nudibranch, *Navanax inermis*, and bubble snail, *Haminoea vesicula*, were relatively abundant, similar to last year. Four *Panulirus interruptus* were observed on band transects (0.0056/m<sup>2</sup>). Several octopus were observed, and they appeared more common than usual.

*Chromis punctipinnis* and *Oxyjulis californica* were the most abundant fish at this site. *Paralabrax clathratus*, *Medialuna californiensis*, and female *Semicossyphus pulcher* were all common. Only one juvenile and one male *S. pulcher* were observed. Female and male *Halichoeres semicinctus* were common. As usual for this site, adult *Hypsypops rubicundus* were relatively abundant, but less so than other years. Juvenile *H. rubicundus* were rare. *H. rubicundus* nests were common, and one tagged *H. rubicundus* was observed. During the roving diver fish count David Kushner counted seven juvenile *Sebastes mystinus* and nine juvenile *S. miniatus*. One adult *S. serriceps* and one *Gymnothorax mordax* were observed. No *Lythrypnus dalli* were observed. No *Coryphopterus nicholsii* were observed on quadrats and they were relatively uncommon along the transect. *Alloclinus holderi* densities remain relatively high at 1.5/m<sup>2</sup>, but have gradually declined the last two years. Roving diver fish count was conducted on June 16 with five divers observing 21 species and on August 18<sup>th</sup> with eight divers observing 20 species.



We observed two notable changes with regards to fish between our June and August visits. In August we observed eight juvenile *Chromis punctipinnis*, none were observed in June. *C. punctipinnis* have had poor recruitment this year during the summer. A noticeable decrease of juvenile vermillion rockfish, *Sebastes miniatus*, was apparent between our June and August visit.

The temperature loggers were working properly and all temperature data was successfully downloaded.

**Location: Cat Canyon, Santa Barbara Island**

1999 sampling dates: 6/15, 8/18.

1999 status: *Strongylocentrotus franciscanus* barrens.

Overall, this site was barren with little macroalgae and encrusting invertebrates. Similar to last year, few *Macrocystis pyrifera* plants were present along the transect, however there were several small patches of *M. pyrifera* observed just outside of the transect area. The only *M. pyrifera* present within the transect area was a small patch with about 10 plants just within the transect on the inshore side. This small area consisted of several large rocks surrounded by sand, and had a thick understory of *Cystoseira* sp. No *M. pyrifera* was observed on quadrats, band transects or RPCs. No macroalgae was observed on quadrats this year. Not including coralline algae, the most abundant “algae” recorded was miscellaneous plants. This category consisted of filamentous brown diatoms, and covered 6.2% of the bottom, a decline from last year. Miscellaneous red algae cover was 1.2% and consisted mostly of filamentous red algae. Articulated and encrusting coralline algae covered 3.2% and 55% of the bottom respectively. Bare substrate covered 29% of the bottom.

Similar to last year, there were few encrusting invertebrates along the bottom. Miscellaneous invertebrate cover on RPCs was similar to the last two years at 5.7%, and consisted mostly of the worm, *Spirobranchus spinosus*, and hydroids. *Phragmatopoma californica* cover continued to be low, at 0.12%. Bryozoans were more common than last year with cover of 4.0%. Tunicate cover remained low for this site at 0.17%, the lowest since 1986.

The entire transect was sea urchin barrens with *Strongylocentrotus franciscanus* the dominant sea urchin. *S. franciscanus* density was similar to last year, remaining high at 7.8/m<sup>2</sup>. *S. purpuratus* continued to decline for the fourth consecutive year. This year's density was recorded at 1.9/m<sup>2</sup>. This is the lowest density recorded at this site since monitoring began in 1986. Most of the *S. franciscanus* and *S. purpuratus* were out in the open, and not confined to crevices. Juvenile *S. franciscanus* were rare. Juvenile *S. purpuratus* were abundant in some areas, but appeared to have a lower abundance than the other two Santa Barbara Island sites. Several *S. franciscanus* were observed with sea urchin wasting

disease on August 18<sup>th</sup>. Both *S. franciscanus* and *S. purpuratus* with shortened spines were common, this may be indicative of disease being present at an earlier date. *Centrostephanus coronatus* density continued to increase to 0.46/m<sup>2</sup>, the highest density recorded for this site since we began monitoring this species in 1996.

As usual, *Asterina miniata* were rare at this site. None were found in the quadrats, and only several were observed at the site. *Pisaster giganteus* were rare similar to last year. None were observed on quadrats and on 5-meter quadrats their density was 0.03/m<sup>2</sup>. *Parastichopus parvimensis* were common with a density of 0.58/m<sup>2</sup>. No sea star wasting disease was observed this summer.

Similar to the other two Santa Barbara Island sites, *Lithopoma (Astraea) undosum* increased in density. Density increased over 1200% from last year to 2.0/m<sup>2</sup>. This is the highest density recorded for this site since monitoring began. No *Haliotis* spp. were observed on band transects, and none were found for size frequency measurements this year. *Megathura crenulata* were similar in abundance to last year, with a density of 0.0056/m<sup>2</sup>. *Aplysia californica* were less abundant than last year, but still relatively abundant for this site with a density of 0.22/m<sup>2</sup>. Several *Panulirus interruptus* were observed on band transects, their density was 0.0042/m<sup>2</sup>. The turban snails, *Tegula eiseni*, and *T. aureotincta* remained relatively abundant, similar to past years. Several octopus were observed. Small *Navanax inermis* and *Haminoea* sp. eggs were common.

Although fish diversity increased at this site (see below), overall fish abundance was low. *Girella nigricans*, *Oxyjulis californica*, male and female *Halichoeres semicinctus*, and *Chromis punctipinnis* were all common. Female *Semicossyphus pulcher* were common, but only two juveniles and one male were observed at this site. *Paralabrax clathratus* were common. Adult *Hypsypops rubicundus* were moderately abundant, and only one large juvenile was observed. *Coryphopterus nicholsii* were rare and none were observed during quadrats. *Alloclinus holderi* were relatively abundant with a density of 1.6/m<sup>2</sup>, similar to the last two years. *Lythrypnus dalli* were common with a density of 0.042/m<sup>2</sup>, this was the first time they have been recorded on quadrats since monitoring began at this site in 1986. Roving diver fish count was conducted on June 15<sup>th</sup> with six divers observing 19 species and on August 18<sup>th</sup> with six divers observing 15 species. A higher diversity of fish was present this year. During the two fish counts we observed 15 and 19 species of fish this year, compared to the 1998 counts that had 11 and 13 species.

The temperature loggers were working properly and all temperature data was successfully downloaded.

#### **Location: Near underwater arch off Webster Point, Santa Barbara Island**

Latitude: 33:28.54      Longitude: 119:03.42

1999 sampling dates: 6/14, 6/17

1999 status: Mature *Eisenia arborea* and kelp forest.

A brief survey dive with the purpose of looking for and subsequently shooting video footage of the white abalone, *Haliotis sorenseni*, we observed two years ago.

Divers were split into pairs and each pair headed in slightly different directions around the underwater arch. The area appeared similar to two years ago with some mature *Macrocystis pyrifera* plants around the underwater arch, and a thick understory of *Eisenia arborea*. In the area where there was an abundance of algae, the bottom was encrusted with a high diversity of invertebrates. Since we were specifically looking for *H. sorenseni*, not much time was spent taking notes at this site.

At a depth of 120ft, David Kushner found one large *H. sorenseni* that was possibly the same one observed two years ago. Two pelican buoys were connected together to mark the abalone. After this was done another *H. sorenseni* was found about 3-5 meters away. John Brooks and Diane Brooks then made a dive on the buoys and video taped the *H. sorenseni*.

Later on in the week on July 17<sup>th</sup>, another dive was made to try and shoot some better video footage. Since we were diving for the past three days, only the divers that had cleared on their computers dove to depths greater than 80 ft. John and Diane dove together again and found five abalone, four of which were thought to be *H. sorenseni*. David Kushner dove in an area further west of the arch and did not see any abalone. However, two abandoned lobster pots were found, and one was illegally closed with wire clamps. This pot had six trapped lobsters that all appeared to be legal size. The lobsters were released from this abandoned trap.

## DISCUSSION

### General Biology:

In 1999, *Macrocystis pyrifera* (giant kelp) forests were present at five of the 16 Kelp Forest Monitoring sites. These sites included Wyckoff Ledge at San Miguel Island, Johnson's Lee North and Johnson's Lee South at Santa Rosa Island, Cathedral Cove and Landing Cove at Anacapa Island. The remaining 11 sites were dominated by echinoderms. Pelican Bay, Scorpion Anchorage and Yellowbanks at Santa Cruz Island, and Southeast Sea Lion Rookery and Arch Point at Santa Barbara Island were dominated by *Strongylocentrotus purpuratus*. Hare Rock at San Miguel Island and Cat Canyon at Santa Barbara Island were dominated by *Strongylocentrotus franciscanus*. Rodes Reef at Santa Rosa Island and Gull Island at Santa Cruz Island were dominated by both *S. purpuratus* and *S. franciscanus*. Admiral's Reef, Anacapa Island, was dominated by both *S. purpuratus* and the brittle star, *Ophiothrix spiculata*. Fry's Harbor, Santa Cruz Island was dominated by *Pachythyone rubra*, and had a moderate density of *S. purpuratus*, and *Astrangia lajollaensis*.

All three sites on Santa Barbara Island were sea urchin barrens. Although, there are a few areas around Santa Barbara Island that have small kelp forests or patches of kelp, the three monitoring sites represent the state of this Island well, as much of the Island appears to be sea urchin barrens.

At Anacapa Island, the status of the two sites within the ecological reserve and one site outside the reserve represent the Island well, though they are not equal in proportion to the amount of area inside and outside of the reserve. Both Landing Cove and Cathedral cove continued to have kelp forests with *Macrocystis pyrifera* more abundant than in 1998. These sites represent the other areas within the reserve well. Admiral's Reef, outside of the reserve, continued to be a barren dominated by both *Strongylocentrotus purpuratus* and *Ophiothrix spiculata*. These two species dominate most of the south side of East, and both the south and north sides of Middle and West Anacapa Island. Similar to Santa Barbara Island, with the exception of the ecological reserve, much of Anacapa is echinoderm barrens with a few scattered, small patches of kelp forest.

All five sites on Santa Cruz Island were dominated by echinoderms, mostly *Strongylocentrotus purpuratus*. Kelp forests were present on the West end of the Island, and scattered around the remainder of the Island. There was noticeably more kelp close to shore along the northern side of the Island than has been observed in the past several years.

Kelp forests continued to be relatively abundant around Santa Rosa and San Miguel Islands. However, sea urchin densities continued to increase at all three monitoring sites on Santa Rosa, and both sites on

San Miguel. If this increase in sea urchin densities persists, we may observe a similar pattern as what occurred several years after the 1983/1984 El Niño, when sea urchin barrens developed.

Overall, *Strongylocentrotus purpuratus*, *S. franciscanus*, and *Lytechinus anamesus* densities increased in 1999. Nine sites had high ( $> 15/\text{m}^2$ ) *S. purpuratus* densities compared to seven in 1998, and 11 sites increased in density, four decreased and one remained about the same. Similar to the last several years, *S. purpuratus* dominated many areas on Santa Barbara, Anacapa, and Santa Cruz Islands. In addition, *S. purpuratus* densities increased at all five sites on Santa Rosa and San Miguel Islands. These sites have had relatively low densities during the past decade. *S. franciscanus* densities also increased in 1999. *S. franciscanus* densities increased at six sites, and changed little or remained the same at the remaining 10 sites compared to 1998. *L. anamesus* densities increased at six sites, remained about the same at two sites, and were zero or nearly zero at eight sites where they are typically absent or rare. There was no noticeable trend with respect to *Centrostephanus coronatus* densities when compared to 1998. However, these densities remain among the highest since we began monitoring this species in 1996.

Sea urchin recruitment (*Strongylocentrotus spp.*) was high this year and was most notable in *S. purpuratus* and to a lesser extent *S. franciscanus*. Recruitment was highest at the eastern Islands (Santa Barbara, Anacapa, and southeast end of Santa Cruz Islands) and decreased as one moved Northwest. However, recruitment was still relatively high at these sites. There were notably fewer small *Centrostephanus coronatus* observed this year in both the natural habitat and ARMs.

There appears to be little sign of change from the current state of extensive sea urchin barrens in the near future. This increase in sea urchin densities in 1999 is parallel to what was observed after the 1983/1984 El Niño in a similar time-line. If this is any indication of what some of the sites will be like in the next several years, we should expect to see sea urchin barrens persist and expand to sites such as Johnson's Lee North and South for at least the next year or two.

Sea urchin wasting disease (Richards and Kushner, 1992) was observed at four sites during 1999. This is less (about 50%) than each of the previous three years. All observations of sea urchin wasting disease were observed at Santa Barbara, Anacapa, and Santa Cruz Islands. No wasting disease was observed at Santa Rosa or San Miguel Islands this year. Similar to previous years, we observed this disease affecting mostly *Strongylocentrotus purpuratus* and *S. franciscanus*, but it was also observed in *Lytechinus anamesus*. No sea star wasting disease was observed this year.

Abundance of the brittle star *Ophiothrix spiculata* changed little at the monitoring sites in 1999. The decline that was observed at Fry's Harbor, Santa Cruz Island and at Admiral's Reef, Anacapa Island in 1998 subsided, and their abundance remained similar to last year. However, we have observed and

continue to hear reports that there are large areas on Santa Barbara, Anacapa and Santa Cruz Islands that have high densities of *O. spiculata*.

*Lithopoma (Astraea) undosum* densities increased dramatically at many of the sites this year. Densities were recorded at their highest level at seven sites since monitoring began. These sites were Southeast Sea Lion Rookery, Arch Point, and Cat Canyon at Santa Barbara Island, Landing Cove and Cathedral Cove at Anacapa Island, and at Gull Island and Scorpion's Anchorage at Santa Cruz Island. At five of these sites there were noticeable decreases in the average size of the *L. undosum*, indicating recent recruitment. Since this species is at its northern most range at the Channel Islands, this increase may have been associated with the 1997/1998 El Niño, but with a lag time. Unfortunately, there is still little known about the biology of this species.

Observations of large numbers of juvenile rockfish, *Sebastes spp.* were reported up and down the west coast in 1999, and our observations at the five Park Islands were no exception to this. Overall, juvenile rockfish were abundant and observed at all of the Islands. The most common species of juvenile *Sebastes spp.* we observed at the monitoring sites this year were *S. mystinus* (blue rockfish). Juvenile *S. mystinus* were observed at all 16 of the monitoring sites. Juvenile *S. serripes* were observed at 13 sites, juvenile *S. miniatus* and juvenile *S. serranoides/flavidus* (olive/yellowtail rockfish, these were probably olive rockfish, but could easily be confused with yellowtail rockfish juveniles) were observed at 10 sites. At some sites juvenile *S. serranoides/flavidus* were abundant. Juvenile *S. paucispinis* (Bocaccio) were observed at three sites. Juvenile *S. carnatus/caurinus* (gopher/copper rockfish, we are not positive of their identifications at the juvenile stage) and juvenile *S. atrovirens* were each observed at four sites. Please note that all of the juvenile rockfish mentioned were YOY (young of year).

Juvenile *Semicossyphus pulcher* were less common than the previous two years and is probably a result of La Niña conditions. . We received few reports of *Stereolepis gigas* (giant black sea bass) observations this year. *Stereolepis gigas* were observed at two kelp forest monitoring sites during the 1999 field season. One was observed at Rodes Reef, Santa Rosa Island during the roving diver fish count, and the other was observed at Landing Cove, Anacapa Island.

#### **Unusual Species:**

Several of the warm water species that were observed during 1997 and 1998 were not observed in 1999, a cooler year. The Guadalupe cardinal fish, *Apogon atricaudus*, that were observed at Landing Cove, Anacapa Island were no longer present this year. Pelagic red crabs, *Pleuroncodes planipes*, were observed only twice this year. Once during the first week of February at Scorpion Beach, and at Fry's Harbor on August 2<sup>nd</sup> at Santa Cruz Island..

We continued to observe the sea urchin *Arbacia incisa* this year at Southeast Sea Lion, Santa Barbara Island, but at no other sites. They were noticeably larger than last year, with none that appeared to be recruited this year. It appears that this species has at least temporarily established itself in small numbers at Santa Barbara Island. Similarly, larger *Centrostephanus coronatus* were relatively abundant at many of the sites, but we did not see the recruitment that we did during the past two years.

The Pacific wing oyster, *Pteria sterna*, were still common at Santa Barbara, Anacapa and Santa Cruz Islands. However, they were noticeably larger than the previous two years and no small ones were observed. This probably indicates the lack of new recruitment.

One orange-throated pipe blenny, *Chaenopsis alepidota*, was observed at Pelican Bay, Santa Cruz Island on May 12, 1999. This is possibly a small range-extension for this species.

Several species of salps and pyrosomes were notably abundant almost everywhere in the Channel this year, These are usually relatively rare. *Mola mola* (ocean sunfish) were common during the early part of the summer. Krill, *Euphausia pacifica*, were observed all around the Channel Islands for at least the first six months of 1999. Western gulls as well as other sea birds were reported to have been feeding on the krill. We observed *E. pacifica* washed up on the shore at Christy Beach, Santa Cruz Islands on May 17<sup>th</sup>, 1999.

Two juvenile *Haliotis fulgens* were observed this year in the ARMs. One *H. fulgens* measuring 28mm was found in a ARM at Scorpion's Anchorage, Santa Cruz Island, and one measuring 20mm was found in a ARM at Landing Cove, Anacapa Island. These observations indicate some recruitment of this now rare abalone that was once common at the Channel Islands. It has been at least ten years since we have heard a report of or observed *H. fulgens* from Santa Cruz Island and almost that long for Anacapa Island. One *H. fulgens* shell was observed at Pelican Bay, Santa Cruz Island.

#### **El Niño/La Niña:**

1999 marked the end of the 1997/1998 El Niño and the beginning of a La Niña. Along with the cold water we observed recruitment of cold water species such as rockfish, the beginning of a recovering sea star populations that were devastated by warm waters in 1997/1998.

#### **Temperature:**

Water temperature was notably colder in 1999 than the previous two years. During our first visit to Santa Barbara Island, water temperature was nearly 4 C° cooler than the same time in 1998. Temperatures in the beginning of summer were colder than average, but became closer to normal later on in the summer.

#### **Artificial Recruitment Modules (ARMs):**

The most notable change in the ARMs this year was an increase in *Strongylocentrotus purpuratus*. The increase parallels what we observed in quadrats.

The density of *Centrostephanus coronatus* stopped increasing and was similar to last year. Almost all of the *C. coronatus* observed in the ARMs were larger than last year, indicating growth and little if any new recruitment. *Asterina miniata* and *Pisaster giganteus* densities increased slightly overall, ending their population decline.

Overall, *Haliotis* spp. recruitment continues to be low. Two juvenile *Haliotis fulgens* were found in the ARMs this year. Eleven juvenile *Haliotis corrugata* were observed in the ARMs this year, compared with six in 1998. Two *Haliotis rufescens* were observed in the ARMs, the same as in 1998.

### **Protocol Changes:**

In 1999 we added juvenile fish to the roving diver fish count. Trained kelp forest monitoring staff and other qualified persons counted juvenile fish and adults separately during the roving diver fish count for the fish species that are traditionally counted using the fish transects protocol. Prior to this year, adults and juveniles were combined. For the species that are counted on the fish transect, there are three categories: adult, juvenile and all. The all category is the adults and juveniles combined. For example, there are three categories for *Sebastes mystinus*, (blue rockfish), these are blue rockfish adult, blue rockfish juvenile, and blue rockfish all. The adult and juvenile categories are combined in the field by the observer for the all category. The all category will be comparable to previous years when adults and juveniles were not separated. In addition, if an observer does not feel comfortable identifying adults and juveniles they can simply use the all category.

### **Sampling Difficulties:**

All proposed data collection was completed this year except for some temperature data (see results section) as a result of missing temperature loggers or temperature logger failures.

### **Data Requests:**

In 1999, Kelp Forest Monitoring data was requested by the following: Dr. Halimeda K. Kilborne with the United States Geological Survey was sent all of the random point contact data. Danielle Zacherl with the Department of Ecology, Evolution and Marine Biology at the University of California at Santa Barbara was sent all of the summarized density data for *Kelletia kelletii*, *Panulirus interruptus*, *Lithopoma undosum*, *Diopatra ornata*, *Serpulorbis squamigerus*, and the size frequency data for *K. kelletii*. Laurie Kates with the Environmental Defense Fund was sent both raw and summarized data for *Strongylocentrotus purpuratus* and *S. franciscanus*.



Michael McCoy with Scripps Institute of Oceanography collected sponges and tunicates during one of the monitoring cruises. Michael screens the extracts for possible drug candidates. About 4.6% of the samples tested positive in a human colon cancer cell line (HCT). This is comparable to areas such as Palau which traditionally is thought to be among the best collection sites. Although further investigation is needed, there is much promise that useful compounds are waiting to be discovered in the waters around the Channel Islands.

**Administrative Notes:**

The kelp forest monitoring project staff for 1999 are as follows: Marine Biologist in charge was David J. Kushner and the Biological Technicians were Barbara Hajduczek, Derek Lerma, and Jonathan Shaffer.

The kelp forest monitoring project was awarded \$11,700 from the National Park Service's Natural Resources Cyclical Maintenance Fund. These funds were used to repair and replace the 100 meter transects at each of the monitoring sites. Not including the funds necessary to operate the boats and the Cyclic funding above, the kelp forest monitoring projects budget for 1999 was approximately \$130,000.

**Information Requests:**

If you are interested in obtaining raw data, please write to the address below:

Superintendent  
Channel Islands National Park  
1901 Spinnaker Drive  
Ventura, CA 93001

**Amendments:**

The first page of Appendix F: Roving Diver Fish Count in the 1996, 1997, and 1998 Kelp Forest Monitoring Annual Report contains some errors. This page is the summary of the number of observers and number of species during each of the fish counts for that year. Its purpose is to be able to quickly compare species diversity at the sites. Unfortunately, there was an error in our program and during the earlier years the same species was counted more than once in some instances. This has been corrected and the first pages of these appendices have been recalculated and incorporated in Appendix M of this report.

## **ACKNOWLEDGEMENTS**

This ecological monitoring program was supported by the U.S. National Park Service in cooperation with the California Department of Fish and Game and the U.S. Department of Commerce, National Oceanographic and Atmospheric Administration, Marine Sanctuary Program.

We are deeply indebted to the many divers who have participated in this project in 1999 (Table 5). All of our volunteer divers are associated with other agencies such as NOAA, California Dept. of Fish and Game, and Universities. Without this volunteer base of well-trained and qualified divers it would be impossible to conduct this program at its current funding level. Dan Richards and Gary E. Davis continue to provide advice and support for the project. We also greatly appreciate the efforts of Diane Brooks, Dave Stoltz, Keith Duran, and Dwight Willey for supporting us on the boats, keeping us afloat and underwater. Gordon Bailey drew cover illustration.

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**Table 1.** Regularly monitored species by taxonomic grouping, common name, scientific name and associated monitoring technique.

TAXA/COMMON NAME	SCIENTIFIC NAME	TECHNIQUE
<b>ALGAE</b>		
Miscellaneous green algae		R
Miscellaneous red algae		R
Articulated coralline algae		R
Encrusting coralline algae		R
Agar weed	<i>Gelidium spp.</i>	R
Sea tongue	<i>Gigartina spp.</i>	R
Miscellaneous brown algae		R
Acid weed	<i>Desmarestia spp.</i>	R
Oar weed	<i>Laminaria farlowii</i>	R,Q
Bladder chain kelp	<i>Cystoseira spp.</i>	R
Giant kelp	<i>Macrocystis pyrifera</i>	R,Q,M
California sea palm	<i>Pterygophora californica</i>	R,Q
Southern sea palm	<i>Eisenia arborea</i>	R,Q
Miscellaneous plants		R
<b>INVERTEBRATES</b>		
Miscellaneous sponges		R
Orange puffball sponge	<i>Tethya aurantia</i>	B,S
Southern staghorn bryozoan	<i>Diaperoecia californica</i>	R
Miscellaneous bryozoans		R
California hydrocoral	<i>Stylaster californica</i>	B,S
White-spotted rose anemone	<i>Tealia lofotensis</i>	B
Red gorgonian	<i>Lophogorgia chilensis</i>	B,S
Brown gorgonian	<i>Muricea fruticosa</i>	B,S
Californian golden gorgonian	<i>Muricea californica</i>	B,S
Strawberry anemone	<i>Corynactis californica</i>	R
Orange cup coral	<i>Balanophyllia elegans</i>	R
Cup coral	<i>Astrangia lajollaensis</i>	R
Ornate tube worm	<i>Diopatra ornata</i>	R
Colonial sand-tube worm	<i>Phragmatopoma californica</i>	R
Scaled-tube snail	<i>Serpulorbis squamigerus</i>	R
Chestnut cowrie	<i>Cypraea spadicea</i>	Q
Wavy turban snail	<i>Lithopoma undosum</i>	Q,S
Red turban snail	<i>Lithopoma undosum</i>	Q,S
Bat star	<i>Asterina miniata</i>	Q,S
Giant-spined sea star	<i>Pisaster giganteus</i>	Q,S,M
Sunflower star	<i>Pycnopodia helianthoides</i>	B,S
White sea urchin	<i>Lytechinus anamesus</i>	B,S
Red sea urchin	<i>Strongylocentrotus franciscanus</i>	Q,S
Purple sea urchin	<i>Strongylocentrotus purpuratus</i>	Q,S
Warty sea cucumber	<i>Parastichopus parvimensis</i>	Q
Aggregated red sea cucumber	<i>Pachythyone rubra</i>	R
Red abalone	<i>Haliotis rufescens</i>	B,S
Pink abalone	<i>Haliotis corrugata</i>	B,S

Table 1. Continued.

TAXA/COMMON NAME	SCIENTIFIC NAME	TECHNIQUE
<b>INVERTEBRATES Continued:</b>		
Green abalone	<i>Haliotis fulgens</i>	B,S
Kellett's whelk	<i>Kelletia kelletii</i>	B,S
Giant keyhole limpet	<i>Megathura crenulata</i>	B,S
California brown sea hare	<i>Aplysia californica</i>	B
Rock scallop	<i>Crassidoma giganteum</i>	B,S
California spiny lobster	<i>Panulirus interruptus</i>	B
Tunicates		R
Stalked tunicate	<i>Styela montereyensis</i>	Q
Miscellaneous invertebrates		R
<b>FISH</b>		
Bluebanded goby	<i>Lythrypnus dalli</i>	Q
Blackeye goby	<i>Coryphopterus nicholsii</i>	Q
Island kelpfish	<i>Alloclinus holderi</i>	Q
Blacksmith	<i>Chromis punctipinnis</i>	V
Señorita	<i>Oxyjulis californica</i>	V
Blue rockfish	<i>Sebastes mystinus</i>	V
Olive rockfish	<i>Sebastes serranoides</i>	V
Kelp rockfish	<i>Sebastes atrovirens</i>	V
Kelp bass	<i>Paralabrax clathratus</i>	V
California Sheephead	<i>Semicossyphus pulcher</i>	V
Black surfperch	<i>Embiotoca jacksoni</i>	V
Striped surfperch	<i>Embiotoca lateralis</i>	V
Pile perch	<i>Damalichthys vacca</i>	V
Garibaldi	<i>Hypsypops rubicundus</i>	V
Opaleye	<i>Girella nigricans</i>	V
Rock Wrasse	<i>Halichoeres semicinctus</i>	V
<b>SUBSTRATE:</b>		
Bare substrate		R
Substrate types: Rock		R
Cobble		R
Sand		R
<b>Technique Codes:</b>		
B= Band Transect	M= 5m <sup>2</sup> -Quadrat	
Q= Quadrat	S= Size frequency Measurement	
R= Random Point Contact	V= Visual Transect	
<b>CHANGES IN SCIENTIFIC NOMENCLATURE:</b>		
<i>Patiria miniata</i>	=	<i>Asterina miniata</i>
<i>Astraea undosum</i>	=	<i>Lithopoma undosum</i>
<i>Astraea gibberosa</i>	=	<i>Lithopoma gibberosum</i>
<i>Hinnites giganteum</i>	=	<i>Crassidoma giganteum</i>
<i>Allopora californica</i>	=	<i>Stylaster californica</i>
<i>Telia lofotensis</i>	=	<i>Urticina lofotensis</i>

**Table 2.** Station Information.

<b>ISLAND</b>	<b>LOCATION</b>	<b>ABBREVIATION</b>	<b>DEPTH METERS</b>	<b>YEAR ESTABLISHED</b>
San Miguel	Wyckoff Ledge	SMWL	13-15	1981
San Miguel	Hare Rock	SMHR	6-9	1981
Santa Rosa	Johnson's Lee North	SRJLNO	9-11	1981
Santa Rosa	Johnson's Lee South	SRJLSO	14-16	1981
Santa Rosa	Rodes Reef	SRRR	13-15	1983
Santa Cruz	Gull Island South	SCGI	14-16	1981
Santa Cruz	Fry's Harbor	SCFH	12-13	1981
Santa Cruz	Pelican Bay	SCPB	6-8	1981
Santa Cruz	Scorpion Anchorage	SCSA	5-6	1981
Santa Cruz	Yellowbanks	SCYB	14-15	1986
Anacapa	Admiral's Reef	ANAR	13-15	1981
Anacapa	Cathedral Cove	ANCC	6-11	1981
Anacapa	Landing Cove	ANLC	5-12	1981
Santa Barbara	Southeast Sea Lion Rookery	SBSESL	12-14	1981
Santa Barbara	Arch Point	SBAR	7-8	1981
Santa Barbara	Cat Canyon	SBCAT	7-9	1986

**Table 3.** Summary of sampling techniques used to monitor population dynamics of selected kelp forest taxa.

TECHNIQUE	SAMPLE NUMBER OF SIZE REPLECATES
Quadrat count	1 m X 1 m 24X / site
Band Transect count	3 m X 10 m 24X / site
5m <sup>2</sup> -Quadrat	1 m X 5m 40X/ site
Random Point Contact	40 points 15X / site (0.5 x 3 m)
Visual Fish transects	2 m(w) X 3 m(h) X 50 m(l) 8X / sites
Video transects	5 minutes / 100 m; 2X / site, and also a 360° pan at 0, 50 and 100m along transect.
Size frequency measurements	30 to 200 / species: 1X / site (see size frequency measurement dimensions below)
Species Checklist	30 - 90 minutes, 1X / site
Artificial Recruitment Modules	7 - 15 modules / site

**Size Frequency measurement dimensions:**

Genus	Minimum Sample Size	Measurement
<i>Macrocystis</i>	100	Stipe count (1 m above bottom), max. holdfast diameter, mm
<i>Tethya</i>	30	Max. diameter, mm
<i>Stylaster (Allopora)</i>	50	Max. height and width, mm
<i>Lophogorgia</i>	30	Max. height and width, mm
<i>Muricea</i>	30	Max. height and width, mm
<i>Megathura</i>	30	Max. shell length, mm
<i>Haliotis</i>	30	Max. shell length, mm
<i>Lithopoma (Astraea)</i>	30	Max. shell diameter, mm
<i>Kelletia</i>	30	Max. shell length, mm
<i>Crassedoma (Hinnites)</i>	30	Max. shell length, mm
<i>Strongylocentrotus</i>	30	Max. shell diameter, mm
<i>Lytechinus</i>	200	Max. test diameter, mm
<i>Pycnopodia</i>	200	Max. test diameter, mm
<i>Asterina (Patiria)</i>	30	Length of the longest ray, mm
<i>Pisaster</i>	30	Length of the longest ray, mm
	30	Length of the longest ray, mm



**Table 4.** 1999 Kelp forest monitoring site status.

<b>ISLAND/SITE</b>	<b>STATUS</b>
<b><u>San Miguel Island:</u></b>	
Wyckoff Ledge	Mature kelp forest with relatively little understory algae for this site.
Hare Rock	<i>Strongylocentrotus franciscanus</i> Barrens.
<b><u>Santa Rosa Island:</u></b>	
Johnson's Lee North	Kelp forest.
Johnson's Lee South	Mature kelp forest.
Rodes Reef	<i>Strongylocentrotus franciscanus</i> and <i>S. purpuratus</i> barrens with moderate encrusting invertebrate cover on the western half of the transect.
<b><u>Santa Cruz Island:</u></b>	
Gull Island South	<i>Strongylocentrotus purpuratus</i> and <i>S. franciscanus</i> barrens.
Fry's Harbor	Open area with high densities of aggregating red sea cucumbers, <i>Pachythyone rubra</i> and moderate abundance's of <i>Astrangia lajollaensis</i> and <i>Strongylocentrotus purpuratus</i> .
Pelican Bay	<i>Strongylocentrotus purpuratus</i> barrens.
Scorpion Anchorage	<i>Strongylocentrotus purpuratus</i> barrens.
Yellowbanks	<i>Strongylocentrotus purpuratus</i> barrens.
<b><u>Anacapa Island:</u></b>	
Admiral's Reef	<i>Strongylocentrotus purpuratus</i> and <i>Ophiothrix spiculata</i> (brittle star) barrens.
Cathedral Cove	Kelp Forest
Landing Cove	Open kelp forest.
<b><u>Santa Barbara Island:</u></b>	
Southeast Sea Lion Rookery	<i>Strongylocentrotus purpuratus</i> and <i>S. franciscanus</i> barrens.
Arch Point	<i>Strongylocentrotus purpuratus</i> barrens.
Cat Canyon	<i>Strongylocentrotus franciscanus</i> barrens.

**Table 5.** 1999 Kelp Forest Monitoring Program participant and cruise list.

<b>PARTICIPANTS</b>	<b>AFFILIATION</b>	<b>CRUISES PARTICIPATED</b>
Becker, Bonnie	Cabrillo National Park/Monument	6
Bingham, Shauna	Channel Islands National Marine Sanctuary	5
Brooks, Diane	Channel Islands National Park	3,4,6,7,8,9
Brooks, John	National Park Service, Submerged Cult. Res. Unit.	3
Bullard, Aimee	University of California, Santa Cruz	4
Canestro, Don	University of California, Santa Cruz	9
Cassano, Ed	Channel Islands National Marine Sanctuary	1,2
Collier, Chantal	University of California, Los Angeles	7
Conti, John	Volunteer, Channel Islands National Park	8
Custer, Buck	Channel Islands National Park	3,4,5
Donahue, Megan	University of California, Davis	7
Duran, Keith	Channel Islands National Park	6
Fangman, Sarah	Channel Islands National Marine Sanctuary	1,2,8
Goodson, Julie	Channel Islands National Marine Sanctuary	4
Haaker, Peter	California Department of Fish and Game	7
Hajduczek, Barbara	Channel Islands National Park	3,4,5,6,7,8,9
Jorgensen, Salvador	University of California, Davis	3
Kennedy, Kathy	Moss Landing Marine Laboratory, Cal. State Univ.	7
Koehnke, Jill	California State University, Fullerton	5
Kushner, David	Channel Islands National Park	1,2,3,4,5,6,7,8,9
Lafferty, Kevin	Biological Resources Division, USGS	9
Lerma, Derek	Channel Islands National Park	3,4,5,6,7,8,9
McCoy, Michael	University of California, San Diego	4
Readie, Mark	University of California, Santa Cruz	6
Reisenbichler, Reg	Biological Resources Division, USGS	4
Richards, Dan	Channel Islands National Park	5,7
Shaffer, Jonathan	Channel Islands National Park	3,4,5,6,7,8,9
Swenson, Dan	University of California, Los Angeles	3
Taniguchi, Ian	California Department of Fish and Game	6
Trone, John	University of California, Santa Cruz	9
Walton, Ann	Channel Islands National Marine Sanctuary	2
Willey, Dwight	Channel Islands National Park	5
Wyndham, Alex	University of California, Santa Barbara	5

<b>CRUISE NUMBER</b>	<b>1999 CRUISE DATES</b>	<b>KELP FOREST MONITORING SITES VISITED</b>
Cruise #1(Lead Line)	May 12	SCFH, SCPB
Cruise #2(Lead Line)	May 13	SCYB
Cruise #3	June 14 - 18	SBSESL, SBCAT, SBAP, ANLC
Cruise #4	June 28 - July 2	SCGI, SRRR, SMWL, SMHR, SCPB
Cruise #5	July 19 - 23	SCYB, SRJLNO, SRJLSO, SCYB, ANCC
Cruise #6	August 2 - 6	SCFH, SCPB, ANLC, ANCC, SCSA
Cruise #7	August 16 - 20	ANAR, SCYB, SBSESL, SBAP, SBCAT, SCGI, ANLC
Cruise #8	September 13 - 17	SCYB, SRJLNO, SRJLSO, SMWL, SMHR, SRRR, SCSA
Cruise #9	Sep. 27 - Oct. 1	ANLC, ANCC, SCGI, SRJLNO, SRJLSO, SCPB, SCSA

**Table 6.** 1999 Echinoderm wasting disease/syndrome observations.

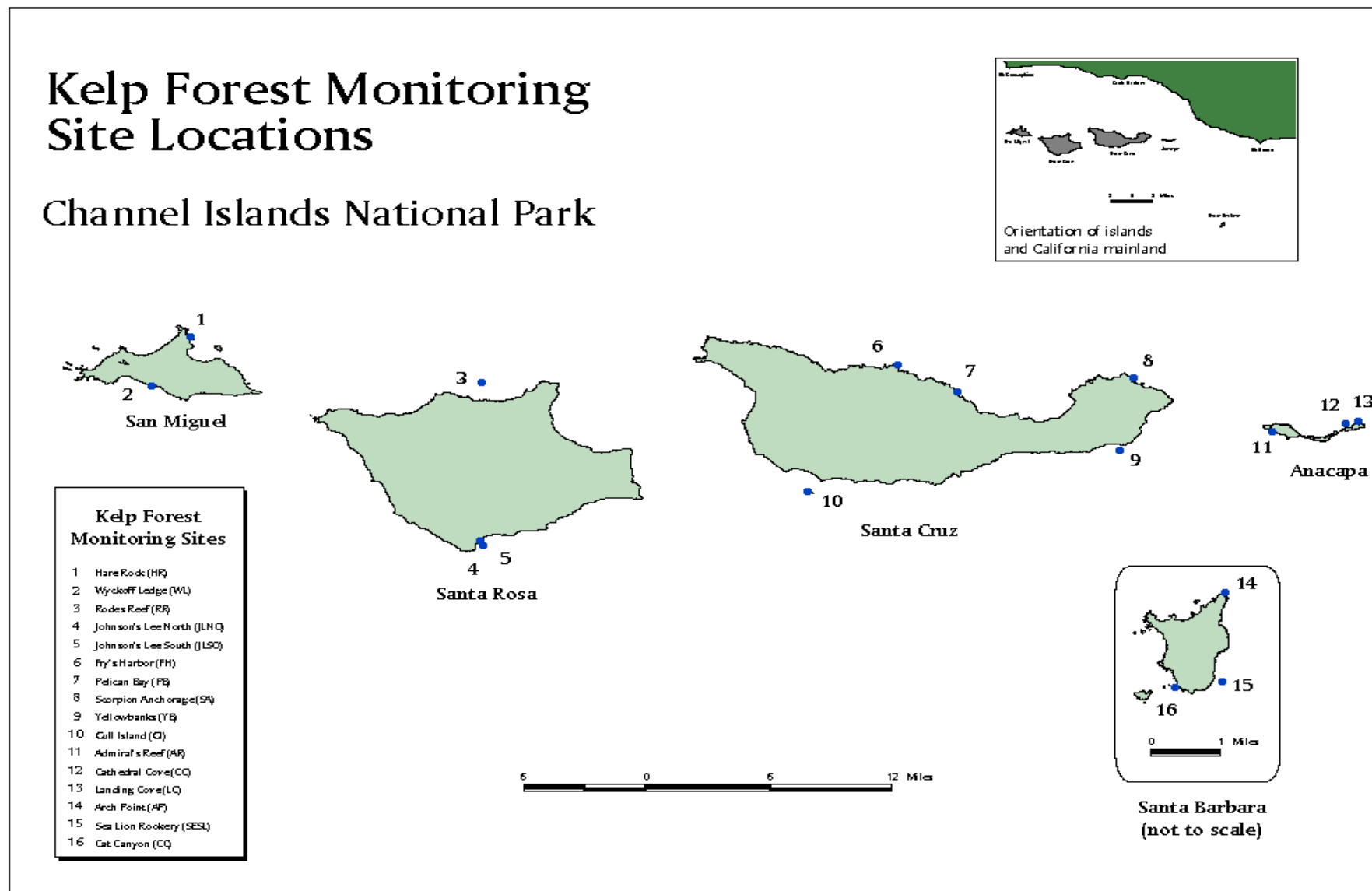
ISLAND/SITE	Sea Star Wasting Syndrome		Sea Urchin Wasting Syndrome	
	SPECIES OBSERVED	DATE(s)	SPECIES OBSERVED	DATE(s)
<b><u>San Miguel Island</u></b>				
Wyckoff Ledge	none		none	
Hare Rock	none		none	
<b><u>Santa Rosa Island</u></b>				
Johnson's Lee North	none		none	
Johnson's Lee South	none		none	
Rodes Reef	none		none	
<b><u>Santa Cruz Island</u></b>				
Gull Island South	none		none	
Fry's Harbor	none		none	
Pelican Bay	none		none	
Scorpion Anchorage	none		none	
Yellowbanks	none		2,6	7/22, 8/17
<b><u>Anacapa Island</u></b>				
Admiral's Reef	none		3	6/18
" "			2,6	6/18, 8/16, 8/17
Cathedral Cove	none		none	
Landing Cove	none		none	
<b><u>Santa Barbara Island</u></b>				
SE Sea Lion Rookery	none		3	8/18
Arch Point	none		none	
Cat Canyon	none		6	6/15, 8/18

**SPECIES LEGEND:**

- 1 = *Asterina (Asterina (Patiria)) miniata*
- 2 = *Strongylocentrotus purpuratus*
- 3 = *Lytechinus anamesus*
- 4 = *Pisaster giganteus*
- 5 = *Astrometis sertulifera*
- 6 = *Strongylocentrotus franciscanus*
- 7 = *Parastichopus parvimensis*
- 8 = *Dermasterias imbricata*
- 9 = *Mediaster aequalis*

none = not observed at this site during our visits in 1997

date = date(s) disease/syndrome was observed



**Figure 1.** Kelp Forest Monitoring Locations at Channel Islands National Park.